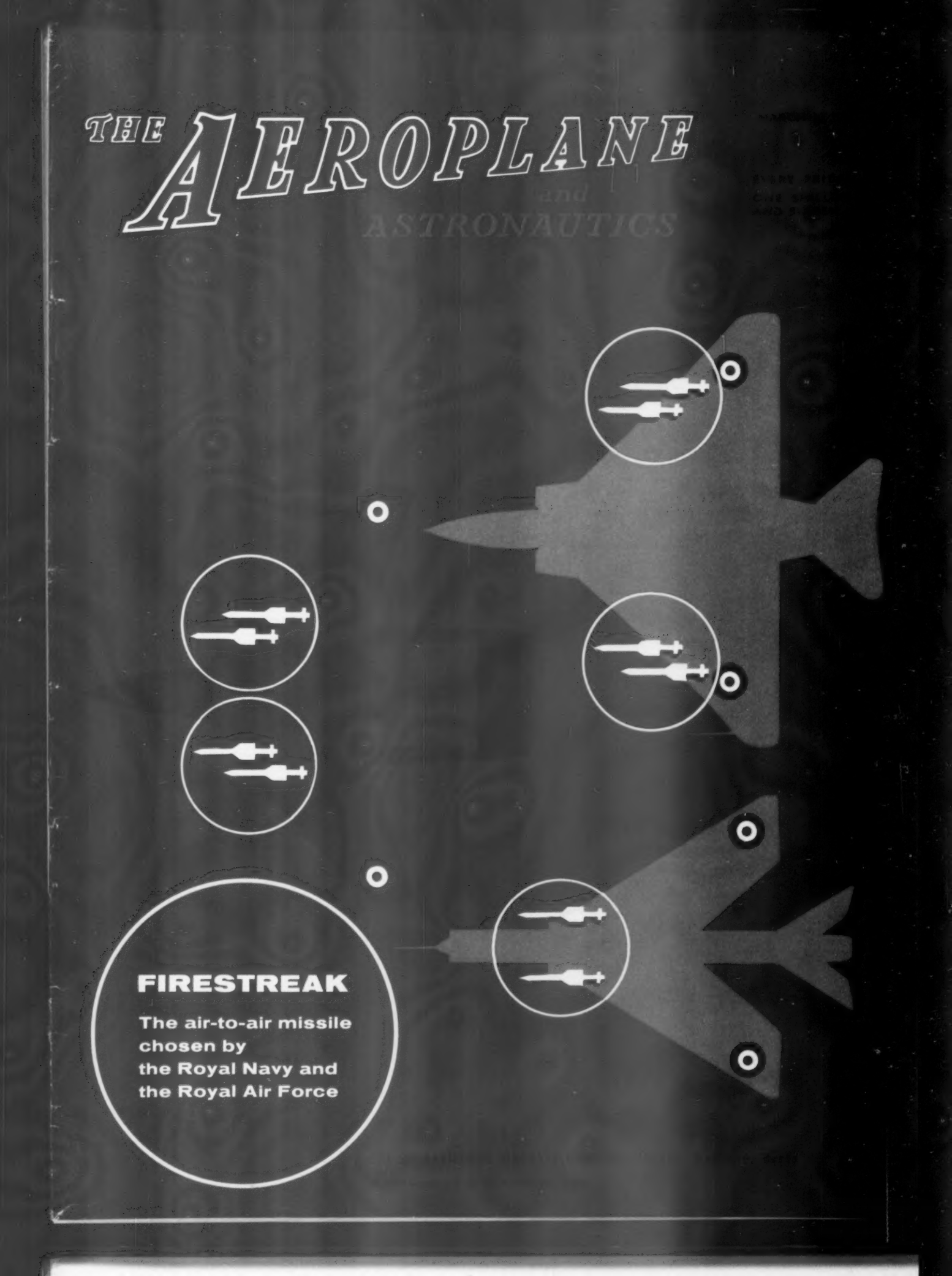
THE AEROPLANE and ASTRONAUTICS



LOS ANGELES–LONDON

B·O·A·C fastest

on SHELL

BOAC's new direct jet service between Los Angeles and London will be the fastest linking the two cities. Rolls-Royce powered Boeing jetliners, using AeroShell Turbine Fuel, will fly the 5,443 miles in 11 hours. With this new service, BOAC's route pattern will cover 120,832 miles in all six continents. At airports throughout this vast network, Shell supplies the fuel on which BOAC's aircraft operate.

SHELL

Last year BOAC flew 52,000,000 miles on Shell Aviation Fuels

Second class postage paid at New York, N.Y.

Combined operations
produce the World's finest fire fighting vehicles

Pyrene TRADE MARK

FIRE EXTINGUISHING TENDERS

built on **THORNYCROFT** CHASSIS

powered by **ROLLS-ROYCE** ENGINES

EN ROUTE TO HUNGARY *Four of these Foam Tenders were specially commissioned by the Hungarian Fire Services for use on airfields and oil refineries. The illustration shows them being driven on to the cross-channel S.S. "BARDIC FERRY".*

PYRENE

These vehicles are fitted with Pyrene Foam Generating Equipment that produces either 6,400 i.g.p.m. of foam or h gh-pressure water jets for cooling-down operations.

They are equipped with 500 imp. gall. foam compound tank; 200 imp. gall. reservoir water tank; power-take-off driven compound pump and fire pump; an automatic foam-making system metering compound into water stream at constant percentage. The all-metal bodywork accommodates a crew of 7.

THORNYCROFT

The THORNYCROFT type TFB/B.81 chassis employed in these vehicles is the latest of the long line of their "Nubian" class, famous for outstanding high-speed cross-country performance.
More than 5,000 "Nubians" have been supplied to all parts of the world, and this chassis is a standard for airfield crash tenders with the British and many overseas Governments.
They are designed and constructed to the highest standards of quality to meet the exceptional requirements of this class of duty.

ROLLS-ROYCE

The vehicles here are powered by Rolls-Royce B.81 engines developing 200 B.H.P. at 3,750 R.P.M. Other engines in the range deliver from 80 to 250 horse power.

Tens of thousands of these engines are operating in all parts of the world, giving reliable and satisfactory service.

All Rolls-Royce engines are guaranteed and offered at competitive prices.

Full details concerning these Fire Fighting Vehicles will be supplied on application to any one of the addresses given below.

The Pyrene Company Limited
Sales and Service Dept.,
9, Grosvenor Gardens, London, S.W.1.

Transport Equipment (Thornycroft) Limited
Basingstoke, Hants.

Rolls-Royce Limited
Motor Car Division
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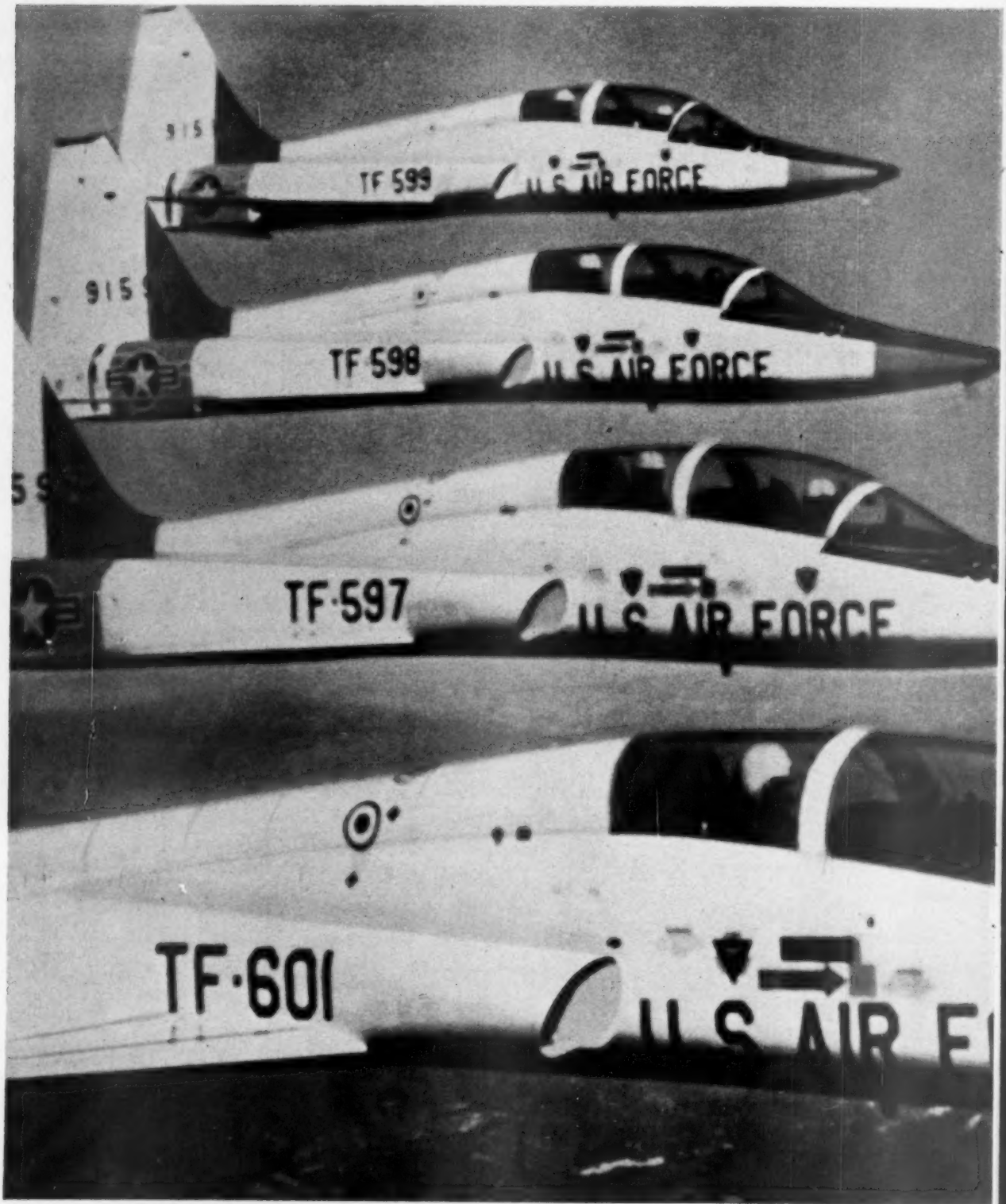

The Northrop T-38 supersonic jet trainer is now

in service with the United States Air Force.

developments in flight equipment . . .

SNAP JACKS AND BOTTLES

Jettison of canopy or drop tank, emergency release of catches or locks is achieved with these self-contained high-thrust jacks requiring no external pressure system. In both snap jacks and snap bottles, stored pressure is retained for a longer period by a metal bursting diaphragm until released either mechanically or electrically. A typical snap jack with 650 ft. lb. stored energy, 3″ stroke, initial thrust of 4,000 lb. weighs 2.4 lb.

Hymatic, as leading engineers in the Aircraft equipment field, have been responsible for the design and precision manufacturing of many products, including

Anti-G valves
High pressure reducing valves
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191

THE HYMATIC ENGINEERING COMPANY LIMITED · REDDITCH · WORCESTERSHIRE

Now, from the world's most experienced builder of jetliners

BOEING 707 BOEING 707 INTERCONTINENTAL BOEING 720

The new short-to-medium range Boeing

727

The superb new Boeing 727 offers airlines a high-performance, high-profit jetliner for service over short-to-medium range routes. With it, airlines will be able to extend jet service to many more cities. Eastern and United airlines have already ordered eighty 727s. Deliveries will begin late in 1963.

The three-engine 727 incorporates many of the structural and systems components that have been proved in the 707 and 720. It also has the same cabin width, permitting 4, 5 or 6-abreast seating to meet competitive requirements, whether for "big-jet" luxury or for high-density service.

The 727 is designed to operate from 5,000-foot runways with full payload, and to serve economically on routes from 150 to 1,700 miles. It offers the added profit potential of 850 cubic feet of cargo space. Speed is 550 to 600 mph.

Of equal importance, the 727 is backed by the outstanding performance, reliability and passenger appeal demonstrated in more than 238,000,000 miles of Boeing jetliner operations . . . good business reasons why *more* airlines have ordered *more* jetliners from Boeing than from any other manufacturer in the world.

BOEING

These 20 airlines (plus MATS*) have ordered 337 Boeing jetliners:* AIR FRANCE · AIR-INDIA · AMERICAN · AVIANCA · B.O.A.C. · BRANIFF · CONTINENTAL · EASTERN · EL AL · ETHIOPIAN · IRISH LUFTHANSA · PAN AMERICAN · QANTAS · SABENA · SOUTH AFRICAN · TWA · UNITED · VARIG · *and* WESTERN. *In addition,* NORTHEAST, PERSIAN *and* PAKISTAN *operate Boeing jetliners under lease.*

PERFECT PAIR FOR **HYDRAULIC SEALING**

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Synthetic rubber-impregnated fabric, bonded with resilient synthetic rubber filling.

★ Stands up to severe punishment.
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★ No down-at-heel wear from fluid pressure distortion.
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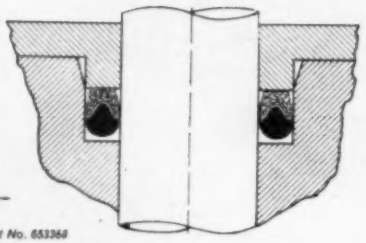
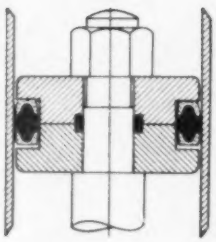
British Patent No. 734525, Canadian Patent No. 653368 (pending), U.S.A. Patent No. 2,755,118.





For double-acting applications:

NEW "HALLPRENE" Patent Double-Acting Fluid Seals.

★ One seal replaces two—reducing costs.
★ Simplifies piston design.
★ Prevents formation of fluid traps.

British Provisional Patent No. 25202/59, French Patent No. 1241572, U.S.A. Patent No. 2,958,516. Patents Applied for in other Commonwealth and European Countries.

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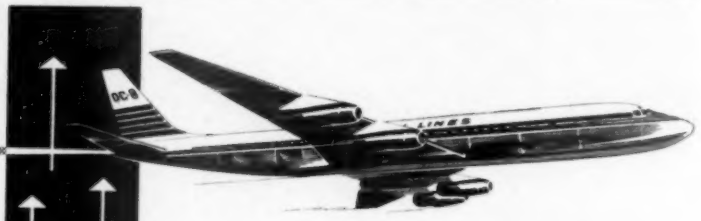

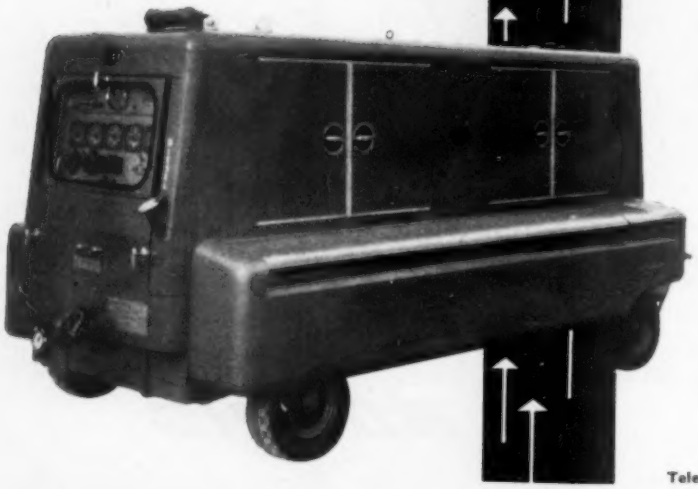

AIR POWER AT GROUND LEVEL

Houchin HY-CY Ground Power Units supply power to service giant airliners. Made by the manufacturers of all kinds of Rotating Electrical Generators, HY-CY is recognised throughout the world as the finest name in high frequency equipment. All equipment can be adapted to your requirements.

Illustrated is the Mark III Ground Power Unit available for outputs from 60 to 100 k.V.a. incorporating a brushless Alternator of latest design, flexibly coupled to a 1500 r.p.m. Diesel engine, total harmonic content less than 1%. Modulation less than 0.1% NL-FL.

Notable features are draw out switch gear and canopy which can be removed in less than 30 minutes to facilitate top overhaul of engine.

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BEA Comet 4B at Central Airport, Athens

Europe's Foremost Airline earns foreign currency for Britain

British European Airways started the 60's with a story of sound commercial success, a dramatic cut in fares on 400 routes and a profit for the seventh successive year.

Vickers Vanguard taking passengers aboard at London Airport (Heathrow)

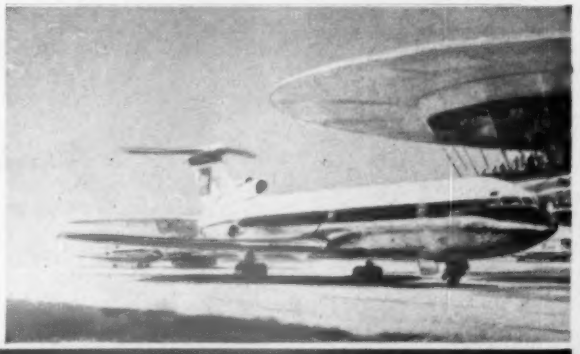
HOW BEA EARNS MONEY FOR BRITAIN Last year its fleet of turbined-engined aircraft — Viscounts, Vanguards, and Comet 4Bs — flew the airways of Europe to the tune of £28,500,000 in revenue. Of this £14,500,000 was paid in foreign currency — £2,750,000 in dollars. And in 1961 the rate of export earning will soar as BEA increases its passenger and freight capacity.

This capacity is now huge: 600,000 more passengers were carried in 1960 than in 1959 — a total of 3,866,000, producing a revenue of £41,250,000. By carrying 26% of all Europe's air traffic and earning 36% of its total revenue abroad, BEA contributed to Britain's export drive.

SELLING BY FLYING This is only one aspect of BEA's part in the drive for exports. Since, for successful export selling, so much depends on meetings of principals, Britain's businessmen are going abroad — and they are going by BEA. Business executives know that BEA flies to more places more frequently than any other European airline. The spring-boards of the export drive are London's airports.

ALL TURBINE — ALL BRITISH In seven years BEA has invested £69,000,000 in the British aircraft industry. Today, the airline has orders placed for £81,000,000 of British aircraft. BEA's support has enabled Vickers to develop the record-breaking Viscount and the new Vanguard aircraft, helped de Havilland to build the Comet 4B and D.H. Trident, and Rolls-Royce to develop the internationally famous Dart, Tyne and Avon turbine engines. Now, this enlightened long-term policy for short-haul airline operation is paying dividends — BEA international services are all turbine and all British. And exports and orders in the last three years for British aircraft and engines amount to £452,000,000. BEA is proud to have helped the British aircraft industry by its example.

The D. H. Trident



BRITISH EUROPEAN AIRWAYS

15,000 feet above the Farnborough crowd, test pilot Bill Bedford threw the red Hunter two-seater trainer into a spin. Falling 10,000 feet in fifty seconds he corkscrewed 12, 13, 14 times — then regained perfect control.

"You saw for yourself" he said, "how hard it was to get into a spin, you have to be really brutal. But in training, we have got to be able to teach pilots how to spin and how to get out of a spin — just in case."

HAWKER SIDDELEY AVIATION *32 Duke Street, London, S.W.1*

THE AEROPLANE and ASTRONAUTICS

VOLUME 100 NUMBER 2577 MARCH 10, 1961

No Noise About It

On Friday of last week—with no advance notice for anyone except those in the secret—the prototype Rotodyne was flown to and from the Westland heliport so that noise measurements could be made from seven selected sites in central London. It first flew from White Waltham above the River to the Docks, which it reached about 10 o'clock and returned to base. It then took off again and arrived at the Westland heliport at 11.15. Here the trials—which involved a descent and "wave-off" followed by its first landing ever on the Battersea platform—were observed by the Minister of Aviation, Mr. Peter Thorneycroft, the Secretary of State for Air, Mr. Julian Amery, and the M.o.A. controller of aircraft, Sir George Gardner and members of his staff. The guests were received at the heliport by Mr. Eric Mensforth, chairman of the Westland Group and by Mr. E. C. Wheeldon, the Group's deputy chairman and managing director.

Last time outcry in Parliament and elsewhere on the subject of helicopter noise was at a maximum, we were proceeding on our lawful occasions across Waterloo Bridge in a taxicab. Seeing a helicopter above us coming into land at South Bank we urged our taxi-driver to follow it. Unfortunately, however great the noise it made was alleged to be, our cabbie had failed either to perceive the machine or to hear it. It took sufficiently long to explain what we wanted for our quarry to have escaped before we reached the scene. However, it did make us realize how little the noise of a helicopter stands out above normal traffic noises in London.

On this occasion also it seems that the allegedly noisy Rotodyne made so little impression above the busy city's roar that very few people indeed had any idea that it was on trial for its very life.

Is it too much to hope that Mr. Thorneycroft, who has shown himself so alive to the needs of aviation, will take heart from this experiment and order intensive trials with this Rotodyne prototype? We ought to have an L.A.P./Gatwick service run by the Rotodyne. This would really give us some useful experience.

A Green For Revenue

From the Ministry of Aviation the fiat has gone forth that ever more punitive charges are to be laid on those who venture by self-driven car to the most expensive airport in the World. From Mar. 20 car-owners are to be charged up to £2 per day for parking their cars in the central area. There is nothing strange about the fact that this news should reach us at a time when we are receiving an increasing number of complaints about the lack of parking facilities at L.A.P.

As with most other kinds of accommodation at the airport, the space provided for parking cars is inadequate. Would-be travellers by air are complaining that they have missed their connection through failure to find in time a place to park their car in.

The solution immediately springing to mind, or at any rate to the minds of those responsible for the airport, is to put up the rates against those who leave their cars for more than an hour or two. A first step that might be more effective would be the ruthless elimination of all cars from car parks that do not belong to *bona-fide* travellers.

The next step should be to see how the classic economics situation of too many consumers chasing too few goods could be used to raise L.A.P.'s insufficient revenues. Any ideas?

Editor - - - - THURSTAN JAMES
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Matters of Moment

Exports and Aero-Electronics

IN addition to its known capital goods exports which have risen in value from £21 million in 1957 to about £28 million last year, the electronics industry's total contribution to the United Kingdom's export trade also covers a considerable portion included in the value of aircraft orders. This indirect export is now thought to run to several million pounds a year.

Giving these and other facts at the annual luncheon of the Electronic Engineering Association held recently, the retiring chairman, MR. L. T. HINTON, went on to say that following its recommendation to a sub-committee of the House of Commons Select Committee on Estimates, the Association now has the opportunity to brief Service Attachés before they take up their posts overseas. So far, four such briefing meetings have been held for these officers on the commercial and industrial aspects of the equipment and weapons pertaining to their Service.

Responding to the Association's chairman, the principal guest, MR. C. I. ORR-EWING, Civil Lord of Admiralty, reminded his audience that the recently published Defence and Service estimates are some £50 million up on last year's figure. A salient point for the electronics industry is the expansion in research and development, especially by the Ministry of Aviation who has spent approximately £200 million in the past year on R. and D.

Commenting on some of the main changes in the cost of defence, Mr. Orr-Ewing said that the present highest-ever outlay on manpower in the Services and the rising price of hardware were very important factors. In addition to the general increase in this last item, the percentage of electronics in Service aircraft continues to grow; for example, while "black boxes" account for 14% of the cost of a Sea Vixen, this equipment makes up 20% of the total price of the Buccaneer.

NATO and its Next Fighter

AS the first step the NATO Requirements Committee has decided that the new VTOL strike aircraft should be supersonic. It is, of course, far too early for a detailed specification to have been laid down for the aircraft. The preliminary requirement had called for a cruise speed of Mach 0.92.

It seems very unlikely that any firm decisions will be made for many months. There are a number of reasons why this should be so, not the least being the difficulty of settling requirements by a body which has members of many nations. Even a single country often takes years to finalize the requirement for a new military aircraft; the TSR-2 was a case in point.

When many countries are involved in these decisions, the difficulty is multiplied. It becomes even more difficult to set a specification when a new principle such as VTOL is concerned. There is no practical experience of operating VTOL aircraft to draw on.

Little pressure for an immediate decision can be expected from the several countries involved. The F-104G Starfighter will keep several of them busy for the next few years; operational experience with this type might even be necessary before drawing up the final specification for a VTOL strike aircraft for NATO.

Inevitably, there is a clash between national and international interests. Some countries may feel more inclined to develop VTOL aircraft to their own specifications and then to persuade NATO to adopt them. France and Germany are developing VTOL aircraft; so is Britain. NATO can make political decisions, but its member countries have to find the money for new aircraft and they will tend to favour the types which most closely meet their own requirements.

The U.S. is unlikely to press for an immediate decision about the new strike aircraft. It has had a great success in selling the Starfighter to NATO countries and would obviously like to repeat this success. Time here is on the side of the U.S.; the longer a decision is delayed, the more likely it is that suitable VTOL engines, if not airframes, will have been developed for possible sale to Europe.

Britain at the moment is well placed, but time is not on her side; delays will probably strengthen U.S. competition. At present Rolls-Royce and Bristol Siddeley VTOL engines are pre-eminent. VTOL control techniques have been proved by the Short SC.1 and in the Hawker P.1127 we have an operational prototype. Although supersonic versions must inevitably be larger and more expensive, it is certain that supersonic derivatives of the P.1127 have been studied.

But although Britain is in a good position today, this advantage could be lost unless aircraft are ordered for R.A.F. service. Waiting for a NATO decision could prove dangerous; far better for Britain to have a proven aircraft which might well be sold to NATO countries later. It must be accepted that the French will push ahead with a VTOL version of the Mirage III; this aircraft is already supersonic and plans exist for modification to the fuselage to house eight or more Rolls-Royce VTOL engines

Records in the Air

BUT for the fact that the regular airline schedule of 36 hr. elapsed time is about half that planned by racing driver Ron Flockhart to beat H. F. Broadbent's 1937 solo record from Sydney to London (which still stands at 124 hrs.), his attempt last week in a converted North American Mustang fighter had nearly all the elements of the pre-War record-breaking days. Bad weather and engine trouble were the almost inevitable accompaniments, and it was the latter which finally grounded him in Athens on Mar. 3, after an eventful flight from Sydney.

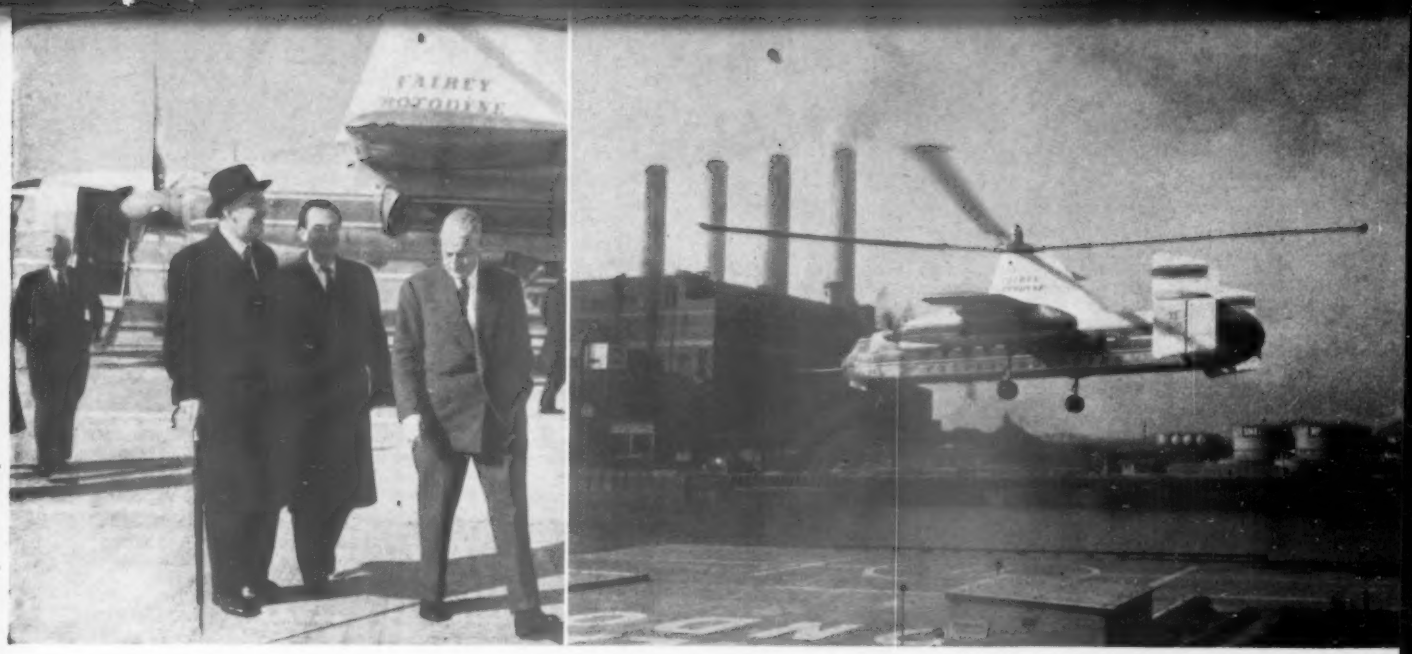
As a moderately experienced light aeroplane pilot Flockhart had converted to the high-performance Mustang without difficulty in Australia. He completed about 22 hours' flying in it before taking off on Feb. 28 for the attempt. With a max. range of about 2,000 nautical miles, he landed at Darwin the same day, after an eight-hour flight, and reached Singapore, via Baucau (Timor) and Djakarta on Mar. 1.

He was reported at Beirut early in the morning of Mar. 3, after landing at Rangoon, Calcutta and Karachi, but with 20 hr. to go to establish a new record, was grounded by engine trouble in Athens. His aeroplane, "United Dominions," purchased by U.D.T., remained there; he arrived back by B.E.A.

In America, light aeroplane record-breaker Max Conrad, who has the unprecedented total of 39,000 hrs. flying experience,

Photograph copyright "The Aeroplane and Astronautics"

TURBINE DEMONSTRATOR.—The Nord 1100 test-bed for the Turboméca Astazou turboprop was due at Gatwick on Mar. 8 for a U.K. demonstration. This automatically-controlled lightweight powerplant has achieved remarkable success in the Beech Marquis installation.



HEARING FOR THEMSELVES.—On Mar. 3 the Westland/Fairey Rotodyne prototype landed at the Westland heliport at Battersea. To hear it (L. to R.) were Mr. Tony Milward (B.E.A.), Mr. Peter Thorneycroft (Minister of Aviation) and Mr. Julian Amery (Air Minister). With them is Mr. Ted Wheeldon (Westland).

took off from Miami on Feb. 28 in a specially equipped Piper Aztec on a nine-day 25,457-mile round-the-world flight. He is attempting three new F.A.I. long-distance records, for absolute speed by a piston-engined aircraft; the absolute Class C-1-d record, aircraft between 1,750/3,000 kg. (3,858/6,614 lb.); and the U.S. national record for the same class.

He took 14 hr. to fly from Miami to Long Beach, Calif., on the first leg of his flight, and reached Honolulu, where he stopped for only 2½ hr., on Mar. 1, before setting off for Wake Island. He then set off for the remaining stops on his route, which included Manila, Singapore, Bombay, Nairobi, Lagos, Dakar, Trinidad and Miami.

Napier's Future

A LOSS of £1,520,000 during 1960 was made by D. Napier and Son, Ltd., which is owned by English Electric, Ltd. In his annual statement to shareholders Lord Nelson, chairman of English Electric, said: "We felt it essential for engine development to be continued during the year and the basic work is now substantially complete. We thought it prudent, however, to write off this development expenditure together with early production costs of components."

After his annual statement had appeared in the newspapers, he said on Feb. 28: "Certain Press comments on my annual general report to shareholders implying that Napiers are going out of the aero-engine business are without foundation. Work continues on present and future projects. I have stated in my report that we recognize the importance of rationalizing the technical and productive resources of the country as an essential policy and studies are being made on the rationalization of the aero-engine industry as encouraged by the Government. Any such arrangements in the future must obviously safeguard the interests of customers at home and overseas and the staff and workpeople."

Boulton Paul Takeover

REASONS for the board of Boulton Paul Aircraft recommending acceptance of a takeover bid by the Dowty Group were given in a letter sent to Boulton Paul shareholders on Mar. 1. The directors consider that the position of Boulton Paul, outside one of the larger aircraft groups, is vulnerable. Its relatively small size makes it desirable to join forces with a company looking for additional productive capacity and engaged in similar activities to those of Boulton Paul and also in the commercial field.

On the airframe side Boulton Paul has been making components for the Vanguard, Comet, Victor and Herald. These contracts were negotiated before the formation of the two major aircraft groups and, with the exception of Herald, are coming to an end. Prospects of obtaining further work of this kind are not good because of the capacity available inside the large groups. Boulton Paul airframe business also includes design and development work for English Electric Aviation, but most of its airframe production is represented by the work already described.

Other Boulton Paul interests include a substantial and growing business in hydraulics, particularly in the aircraft field, and press-work for the motor industry, now suffering a recession. These interests would be insufficient to absorb loss of production in the airframe side if it should occur.

Boulton Paul directors consider that the Dowty offer is fair and reasonable. The offer is one fully paid 10s. Dowty share plus 8s. in cash for every two 5s. Boulton Paul stock units. Dowty state that the object of the merger is to provide Dowty with additional manufacturing, design and technical facilities and staff. It is said that the Boulton Paul type of product over many years has been complementary to that of Dowty. The association should ensure continuity to Boulton Paul of the class of work to which they are accustomed.

Helicopter Approach Problems

ALL-WEATHER operation of helicopters into city-centre sites will demand very accurate navigation during the final instrument approach. A higher standard of accuracy and reliability is needed than is offered by equipment now available. The problems of approach guidance and current studies and flight-test programmes in this field were described in a Royal Aeronautical Society (Rotorcraft Section) lecture on Mar. 3 by S. G. Lennox, B.Sc., M.S., A.F.R.Ae.S., helicopter project engineer of British European Airways.

His lecture dealt with instrument approach down to about 200 ft. above the landing pad. Regularity as good as that now achieved with fixed-wing aircraft should be possible with a helicopter blind-approach system which will permit a cloud-break height of 200 ft, followed by a visual approach and landing which is aided by ground lighting.

For operation into a typical city-centre site it is reasonable to assume that glide-path angles will lie between 10° and 20° and that a technique in which a 15° glide-path is followed to a point 50 ft. vertically above the landing site should provide reasonable obstruction clearances without making things too difficult for the pilot.

For landings at open sites, helicopter instrument approaches can be flown on standard airfield GCA and ILS, using a 3° glide-path. Weather limits at least as low as those for fixed-wing aircraft—200-ft. cloudbase and ¼-mile visibility—are acceptable, using the standard fixed-wing approach lighting for visual transition. Using sector-scan radar, with beam coverage of about ±15° in azimuth and ±5° in elevation, and a scan rate of at least two per second, GCA approaches can be flown at glide-path angles up to 10° in similar weather limits.

For approaches to a confined site, however, GCA equipment is rather bulky and cannot easily be reorientated for different approach directions and to give overshoot guidance. The return signal may, too, be difficult to pick up in the clutter from surrounding fixed objects. Safety depends on a ground controller who will need special training for helicopter guidance.

Transport helicopters will probably have a Decca Navigator with large-scale Flight Log presentation for en-route navigation. With this aid, responsibility for the approach is left in the hands of the pilot. But there are serious disadvantages to its use for approach to restricted sites in poor weather. Lack of positive glide-path information is likely to limit the

Matters of Moment . . . .

maximum glide-path angle to about 10°. Loss of signal, due to atmospheric static is possible, and the inherent inaccuracies of the system will. Mr. Lennox considered, probably limit break-off heights to at least 100 ft. above obstacles within 440 to 880 yd. from the landing site, even in areas of good Decca cover.

Either or both of these techniques can be used for approach to fairly open sites in weather with 200-ft. cloudbase and ¼-mile visibility, but tests have shown that more precise, positive and reliable guidance is needed for approach to restricted city-centre sites in bad weather. B.E.A. trials with micro-wave beam aids indicate that the task is not impossible, although neither of the "lash-up" systems used in flight trials provided the answer. One was an Elliott marine harbour course beacon with experimental aerials—a portable equipment producing a straight audio beam with a narrow "on-course" signal about 10 yd. wide. Later trials were made with a Sperry micro-wave glide-path beam developed for fixed-wing aircraft approaches.

As a result of B.L.E.U. and B.E.A. helicopter trials (see issue of Feb. 17, p. 183) the Ministry of Aviation has prepared a formal "Civil Aviation Requirement for Rotorcraft Instrument Approach and Overshoot Guidance." This covers equipment for all-weather rotorcraft operations into city centres.

It calls for information to be provided in the aircraft of displacement in azimuth and elevation relative to the desired straight approach path, together with the slant range from touch-down. This information is to be suitable for display to the pilot on a displacement meter or for coupling into a flight director or autopilot. Similar azimuth information is to be provided about a straight overshoot path determinable within 30° of the extended approach-path centre line. Ground equipment must allow the direction of the approach and overshoot paths to be adjustable to any one of up to four azimuth directions in less than five minutes. Descent-path angle is to be in the range of 10° to 20°. A range of other requirements is specified, including safety characteristics, radio frequencies, and guidance-coverage sectors.

Tribute to Test Pilots

TO those who have grown up in aviation no breed of man is worthier of praise or deserves credit more than the test pilot. Most of us will have ruminated at one time or another that test pilots as a class do not reap rewards worthy of their contribution to the progress of aeronautics.

By virtue of their calling and the talents it requires they tend to individualism; their gatherings are not formal and they have no special means available to present their point of view to the World. Sometimes they write books themselves. Sometimes other people write books about individual test pilots. On occasion joint authorship is achieved.

But one cannot recall any books about test pilots as a collective whole. Now the job has been undertaken, not only about the pilots but to some extent about the machines in which they exercise their art. This book is "Testing Time,"* described as a study of man and machine in the test-flying era. The author, Constance Babington Smith, is no newcomer to aviation. She began by writing for THE AEROPLANE in a highly individual way before the last War. By the time War came she knew enough about the technicalities to do a highly specialized job in the W.R.A.F. She has told something of that work in "Evidence in Camera," in which much official information was made available.

In this book again she has had access to many official papers but in most cases these refer to days so long ago that there could be no inhibition in the use made of them. Indeed, bearing in mind that a considerable proportion of the 20 test pilots Miss Babington Smith has chosen to write about are still with us, it is remarkable with what apparent freedom she has written about them and their doings.

She begins with one whom many will have forgotten. J. W. Dunne, later the author of "An Experiment With Time." It was of him that H. G. Wells wrote that "he was experimenting long before the French and American aviators . . . long before the coming of that emphatic lead from abroad without which no well-bred English mind permits itself to stir." In the faraway days of 1906 Dunne was attached to the Balloon Factory at Farnborough and made a member of the Royal Engineers Committee. He was put in charge of the design, construction and trial of the first British military aeroplane. It is indeed fascinating to read in this book of the fantastic security precautions that were instituted. There seems some evidence that they exercised their usual restrictive effect on the cross-fertilization of ideas.

Cody and Geoffrey de Havilland receive their due meed of attention and it is particularly good to see that A. V. Roe gets his fair share too. A specially instructive section of the book is that devoted to Wilfrid Parke who took off solo the first time he ever got in an aeroplane (April, 1911) and not so long after was flying Avro cabin aeroplanes. It was in one of them, the Avro two-seater cabin biplane, with Lieut. LeBreton, that he made, inadvertently, the celebrated Parke's Dive. It became famous because, having stalled on a turn and begun to spin, he got out of it by reversing the rudder. There is no room here to follow up the history of the spin, though this is a subject in which there is still tremendous interest, as recent letters to our correspondence pages will show.

However, there is much valuable information in this book about the spin. Among the test pilots included is F. A. Lindemann, better known today as Viscount Cherwell. The full extent of his work on the spin is set out for all to see.

It is also good to find that considerable attention is paid

* Published by Cassell, 8½ in. x 5½ in. Price 30s.

IN WHOM WE (AND NATO) TRUST
THE NEW NUCLEAR-PROTECTED HQ OF No.4 GP, R.O.C. WAS OPENED AT COLCHESTER ON MARCH 4 BY COL. SIR JOHN RUGGLES-BRISE, LORD LT. OF ESSEX. IT IS THE SIXTH OF THIRTY BEING BUILT IN THE U.K. TO WHICH THE R.O.C POST OBSERVERS WOULD, IN THE EVENT OF WAR, REPORT AIRCRAFT MOVEMENTS AND NUCLEAR BOMB-BURSTS AND FALL-OUT.
Obs. Capt. BERNARD PARKES Metropolitan Area Cmdt.
Obs. Cdr. JOHN NIXON 4 Gp. Cmdt.
"WE HELP EACH OTHER."
Obs. Capt. H. ST. CLAIR "CHIPS" SHALLWOOD Asst. Area Cmdt. and probably the only Serving man with a Boer War medal and a brevet
A.V.M. CHRIS HARTLEY A.O.C. 12 Gp., Fighter Cd.
"WELL, WE'RE BOTH EXPERTS ON FALL-OUT"
GEORGE POTTER Chief Sector Warning Officer, Home Office, and ex-Specialist Navigator, Coastal Cd.
Obs. Lt. JOHN KOWLANDS Deputy Gp. Cmdt., 4 Gp.
Chief Woman Obs. MRS. PHYLLIS PARR, with ten Master Tests to her credit.
Observer "CHERRY" SPOONER —35 years Service in the Corps
HEAD-ON
PLAN
SIDE
LIGHTNING F.1
HEAD-ON
PLAN
SIDE
H-BOMB MK.IV
"IN THE SWORDFISH DAYS, THINGS WERE SOMEHOW DIFFERENT..."

to the work of the young H. T. Tizard. Sir Henry Tizard was one of the very great men of our era and, like Sir Wilfrid Freeman, he never seemed to get the credit due from his countrymen for the part he played in making victory possible.

Half this book is devoted to the period before 1918, but in the ensuing 40 years there were plenty of great test pilots and many familiar names will be found in these pages. It is not possible to list them all here.

The book ends with Roland Beamont. It would be too much to expect that even the author of "Evidence in Camera" would be able to get much into print about the supersonic fighter which is now becoming operational with the Royal Air Force.

For reasons which are clearly stated most of the machines discussed are military aeroplanes. One feels, however, that the part John Cunningham has played in introducing dependable jet-powered transportation to the civil airlines of the World should have won him more extended mention.

In a book of the size under review it would certainly be hard to deal with more than a couple of dozen personalities: one can certainly not fault the authoress on the men she has chosen to put in. On the other hand there are certain other names one would like to have seen included. There ought to have been something more about Harald Penrose than a tribute to his writing, and it is about time that someone told of Hubert Broad's many contributions to the art.

In view of the remarkable contribution made to aeronautics by the coming of the Autogiro and helicopter it would have rounded the book off to have something of the experiences of those who did so much by their flying tests to make them the useful vehicles they are today.

It is a measure of the merit of this book that such a tremendous amount of worth-while information can be found within its 220 pages. Also that so much of value has been recovered from the past.

In spite of Miss Babington Smith's implication that the day of the test pilot is over, there is going to be plenty for him to do in the years ahead. Not only is the supersonic airliner in the offing but there is the handling and development of VTOL aircraft. We must hope that the demand for "Testing Time" will justify an early decision to proceed with a sequel.—T.J.

Defence—Nuclear and Conventional

MR. HAROLD WATKINSON, Minister of Defence, inaugurated the two-day defence debate in the House of Commons on Feb. 28 by moving approval of the 1961 Defence White Paper (Cmd. 1288), summarized in our Feb. 24 issue. In the result it was approved by 338 votes to 231 against—Government majority 107.

Unlike the practice of recent years in which the Opposition has countered with a declaration of their own defence philosophy, they confined themselves this year to stating, by way of motion by MR. D. W. HEALEY (Lab., Leeds, East), their complete lack of confidence that the Government's policy will prove effective for the defence of this country. The issue was therefore clear-cut and in fact less irrelevance was evident than is sometimes the case in a debate of this importance.

Criticism of the Paper was by no means confined to members of the Opposition, some of whose speakers indeed endorsed the policy in parts, while some Conservative members forthrightly found fault with the Minister's proposals. Thus perusal of the full debate in "Hansard" gives a comfortable impression of party prejudice having been put on one side for the occasion.

Although the debate embraced the entire field of defence it was invitable that uppermost in mind was the issue of the so-called nuclear deterrent—involving the most sombre and formidable menace ever to confront mankind. And, as it is proposed that at any rate for the next decade our "delivery vehicle" shall be the V-bomber, the R.A.F. was very much to the fore in the discussion.

In the latter context it should not be lost sight of that the cost of this country's present proposed participation under this head is no more than some 12½% of the total defence figure, which latter accounts for some 25% of the whole budget. Thus the overall cost of our strategic striking force represents about one thirty-second part of our tax revenue. If, therefore, such an allocation is likely to help preserve peace in the World and serves to maintain our position among the nations, it would seem not an exhorbitant price to pay.

Mr. Watkinson is unenviably faced with a mammoth task. Brains we have, technical skill and logical thinking—but geographically, logistically and economically we are caught short. Saddled with our limitations we cannot hope to match in sheer weight of force—aggressive or retaliatory—either the United States or Russia. The Minister (with his Service and specialist advisers) has reached the conclusion that our contribution to the defence of the West should go to the limit of our resources consistent with preserving intact our domestic economy, and that it should include both nuclear and conventional armament. He visualizes that within this limit such forces as we can field will be by no means a mere token, but will provide a tangible and effective share in that warlike front conceived as the most potent safeguard of World peace.

To back his convictions the Minister outlined the programme of equipment, development and expansion planned for Bomber Command. In doing so he necessarily repeated much already announced by MR. JULIAN AMERY, Secretary of State for Air, in his Memorandum to the Air Estimates 1961-62, reviewed at some length in our Mar. 3 issue. After detailing the proposed progressive arming of the V-bomber force with the Blue Steel stand-off bomb when defences harden, and eventually with the fully ballistic American Skybolt with British warhead, he cited as an illustration of our V-bomber potential that one Vulcan carries a greater load of destructiveness than did our whole Bomber force 10 years ago. He added for good measure that, as it stands ready at the moment, Bomber Command is capable, by itself, of crippling the industrial power of any aggressor nation. On the face of it, having regard to distances which might have to be covered, the latter contention seems to soar into hyperbole—but if the deterrent is effective it will not have to be proved.

Mr. Amery, supplementing the case, reminded the House that we are not financially involved with development of Skybolt, with which he was being kept closely *en rapport*. He had good reports of progress and was satisfied with arrangements already made for our acquisition of the weapon "without strings attached." Questioned as to whether there existed an agreement expressly covering the sale to us of Skybolt, or whether the agreement covered only our participation in its development, he seemed at first a trifle vague, but later said that he "stood by his words."

If this means that a formal agreement, contingent on its successful evolution, for the sale of Skybolt has already been signed, so much to the good. If not, it would seem a matter of common prudence to tie up the issue at once—if only on the legal precept that it is more important to formalize a contract between friends than one between strangers.

Criticism of the White Paper largely took the form of doubt as to the soundness or otherwise in all the circumstances of the Government's policy of going ahead in the nuclear field.

Mr. Healey said that Britain's future defence policy should contribute towards halting the spread of nuclear weapons, whereas a determination to persist in an atomic weapon system for 10 years ahead would tend to do the reverse. Against whom was it proposed to use our independent deterrent? Alone, it stood no chance in offence or defence against a major nuclear power; and as an adjunct to such a power's resources it would be insignificant. In his view our obvious course was to step out of the nuclear rôle and to concentrate on conventional weapons. As things were now, conventional weapons had been much neglected, and at the present time we could be faced with a conventionally armed challenge in Europe which we could not meet save by resorting to atomic weapons. The result would be World War III.

He appealed to the Government to take up this strategic aspect with NATO. If agreement were reached, an approach could be made to Russia on the general principle of limiting arms and forces in as large an area of Europe as possible and establishing ground control posts. It would be a step towards disarmament.

MR. AUBREY JONES (Cons., Birmingham, Hall Green) said they were witnessing the collapse of the aspiration after independence, but he was worried in discerning no clear indication of what was to take its place. The Government were persisting in an independent contribution to the deterrent, but were depending on another country for the vehicle. From what had been said he wondered whether there was an intention to substitute yet another British weapon as insurance against possible non-delivery of Skybolt. He could not imagine greater folly than to cancel a weapon of one's own so as to rely on a weapon from elsewhere, and then to take out an insurance policy against the possible failure of that weapon. That would be sheer madness.

With which principle all right-minded people must surely agree. As things stand, no one, not even its designers in the country of origin, can guarantee that Skybolt will eventually fulfil its promise. Hence the paramount importance, as suggested above, of securing unequivocal right to this country.

Finally, Mr. Watkinson vigorously defended his policy. This, he said, does not rest on a basis either of fulfilling our obligations in NATO to the detriment of our position in the rest of the World or of trying to achieve a false balance in NATO between nuclear and conventional. He repudiated the suggestion that our V-bomber force has no real *métier* in the general defence scheme, instancing that our Mark IIs with Blue Steel will have an exact counterpart in the American B.52 with Hound Dog stand-off. As to Skybolt, in the, to him, unlikely event of the weapon not materializing, we had other means in view of launching the nuclear missile, such as the TSR-2 a weapon system in itself reckoned to be at least two years ahead of any comparable system anywhere.

We cannot, he said, dissociate ourselves from the menace of nuclear weapons, and therefore we seek to turn our obligations to good account. And the way to do this is to take such a practical part as we now propose. In this way, quite apart from the very real potential effectiveness of our contribution, we shall preserve our proper say in council both now and when World-wide disarmament comes to be decided upon.—O. W. H. COOKE.

Air Transport

The Causeless Accidents

AN uncomfortable fact which was not directly stressed in the Cairns Committee report (summarized on the following page) is the way in which the causes of so many non-fatal accidents have remained unexplained and the subject, consequently, of prospectively inaccurate grapevine gossip.

One can think, without reference, of half a dozen accidents to British transport aircraft about which nothing has been officially said and of which no cause or causes have been published. Useful lessons could, no doubt, be learnt from each one of them, but these lessons have remained the secret of the airline concerned—except in so far as reports may (or may not) have been circulated for the guidance and information of other operators.

The worst feature of this situation is that the informed public is inevitably left with the conclusion that the accidents were due to pilot error, whereas, in fact, this might not have been so—or, at the worst, the error may have been the end-product of a succession of contributory difficulties. An approach, for instance (to give a particular case), might have been attempted in sub-marginal conditions because all the available alternates had closed. One does not suppose that last December's expensive accident to a B.O.A.C. 707 when landing at Heathrow was due simply to some massive error of approach judgment—but what else can one assume when no alternative reasons are given?

No airline pilot will have forgotten, either, that there was more than a six-year delay between the events and the publication of an explanation which partially cleared—at least of gross error—the pilots concerned in the Comet 1 take-off accidents at Rome and Karachi. The Cairns Committee's recommendations include one to the effect that inquiries shall be reopened if any additional evidence comes to light.

B.E.A. and Competition

"AIR transport," writes Lord Douglas in the latest *B.E.A. Magazine*, "is already one of the most competitive of industries and I do not believe that the addition of further operators on routes where there is a lot of competition would be of real and lasting benefit to the travelling public. It would certainly not increase the United Kingdom's share of traffic on international routes, because foreign governments will insist on retaining their present share of the traffic."

This comment sums up the B.E.A. attitude towards the B.U.A. and Cunard Eagle applications for parallel services on more than 40 B.E.A. routes—applications which B.E.A. will oppose at the A.T.L.B. hearings in due course. In support of this point of view there is published a list of the Corporation's 20 main competitive routes from London, showing the number of scheduled operators on each according to 1961 summer schedules.

B.E.A. should perhaps have made clear that this listing includes operators offering only transfer-flight connections between the cities listed. The number of through-flight operators is fewer in almost every case—and in several cases very substantially so. For instance, B.E.A. indicates 14 operators to Athens, but only four of these offer direct service; similarly only four out of 12 to Venice offer through service, only two out of six to Moscow, and so on.

The point at issue here—and the point which the Air Transport Licensing Board must eventually decide—is how much real competition there is between through services and transfer-flight connections. It is impossible to generalize in the case of the routes for which the two British independent companies have applied, but it certainly might be argued in some cases that an additional through operator would divert traffic from the indirect services rather than the existing direct ones. The one thing that is certain is that the A.T.L.B. *must* have available to it sound and thorough statistical data if points such as this are be decided equitably.

The First Hearing

ON Tuesday next, Mar. 14, at 2.30 p.m., the Air Transport Licensing Board will hold its first public hearing into licence applications for air services from British operators. The venue for this and the next few hearings will be 3 Dean's Yard, Westminster, S.W.1. A comparatively innocuous "bill of fare" has been chosen for this first meeting, which will serve to allow all concerned to familiarize themselves with the procedures to be followed.

As the list below shows, the applications to be heard on Mar. 14 are concerned solely with inclusive tours, and their most interesting feature is perhaps that all have been opposed by other independent operators. The much more serious work of considering the scheduled service applications from British United Airways and Cunard Eagle is expected to begin in mid-April and to occupy several days.

Applications to be heard on Mar. 14.

1. From East Anglian Flying Services for one I.T. flight a week between Glasgow and Ostend. Opposed by Pegasus Airlines.
2. From Air Safaris for one I.T. flight a fortnight between Glasgow and Palma. Opposed by Starways, Overseas Aviation and Pegasus.
3. From Air Safaris for one I.T. flight a fortnight between Glasgow and Malaga. Opposed by Pegasus and the Colonial Office (representing Gibraltar).
4. From Air Safaris for one I.T. flight a fortnight between Glasgow and Ostend. Opposed by Pegasus and Cunard Eagle.
5. From Air Safaris for one I.T. flight a week between London and Venice. Opposed by Cunard Eagle.
6. From Air Safaris for one I.T. flight a week between London and Perpignan. Opposed by Cunard Eagle.
7. From Air Safaris for one I.T. flight each 10 or 11 days between Bournemouth and Luxembourg. Opposed by Cunard Eagle.

1960 Statistics

AN increase of 22.2% in revenue ton miles flown by British airlines on scheduled services was recorded in 1960, according to M.o.A. operating and traffic statistics. The number of passengers carried went up by 24.8% to 5,886,000, and the average journey distance also increased slightly to produce a 25.6% increment in passenger-miles flown. Available capacity short ton-miles were increased at a slightly greater rate than traffic growth, giving a reduction in overall revenue load factor from 60.9% to 60.0%. The passenger load factor went down from 64.1% to 62.8%.

International services naturally accounted for the larger part of the total effort, but domestic services saw the greater growth rate—31.4% compared with 21.3% in load short ton-miles. Of the two Corporations, B.O.A.C. increased its passenger miles by 29.1% and B.E.A. by 19.6%. Independent airlines in association with B.E.A. and B.O.A.C. recorded an increase of 26.9% on scheduled services and 29.5% on inclusive tours.

SICILIAN SERVICE.—A London - Palermo (Sicily) direct service will be inaugurated by B.E.A. on Jne. 1 using Vanguards. The first Vanguard to visit Sicily—on Feb. 28—is seen here at Punta Raisi Airport.

Licensing Notes

APPLICATIONS recorded in the latest issue of Civil Aviation Licensing Notices are interesting in that they include the first for a Class E licence. This is one in which the terminals to be served are not specified in the licence

The application is from B.E.A. for permission to operate a helicopter service between places all of which are within the U.K., the Channel Islands or the Isle of Man, for all classes of passengers, cargo and mail, from Mar. 30 for an indefinite period. No frequency restriction is specified, and the types of helicopter to be used are listed as Westland WS.55, Bristol 171, Bell 47 and possibly, later, the Bristol 192, Vertol 107, Agusta Bell 204 and Rotodyne. Fares would be not less than B.E.A. domestic passenger and freight rates, with "necessary adaptations resulting from the use of helicopters."

Other applications in the current Notices are from B.E.A. for a scheduled service to Málaga, Spain, and from Air Safaris for a Class C licence for three I.T. flights between London and Palma between Jly. 8 and Aug. 5, to supplement I.T. flights already approved on this route.

Developing New A.T.C. Techniques

UNTIL very recently the plans envisaged by the Ministry of Aviation for the overall development of new air traffic control techniques in the U.K. have been described only in general terms. It was known that specifications and tenders had been invited to meet the Ministry's various requirements and that these had been put in. Some detailed information has been given about the Ferranti Apollo data-processing project for Prestwick—which has specific objectives in relation to North Atlantic A.T.C.—but little has been said about basic research on A.T.C. techniques or about the development of the design of hardware for use at A.T.C. centres of the future.

Last week the Ministry and Elliott-Automation announced that a contract had been placed with Elliott Brothers (London) for A.T.C. equipment to be installed at the Air Traffic Control Experimental Unit at Heathrow. The equipment, to be used for experimentation in the design of future A.T.C. systems, will be based on the Elliott 502 computer and is being designed to accept and distribute data (simulated or otherwise); to complete the necessary calculations; and to operate electronic or electro-mechanical indicators on flight-data displays.

The initial equipment will simulate the control of aircraft flying in the London F.I.R. and will include facilities to provide simulated flight plans, aircraft position reports, radar echoes, and radio and landline messages, as well as the displays for flight data and televised weather information.

The objects of the programme will include the development of new procedures—making use of computers into which data will be fed from flight-plans, primary and secondary radar and airborne navigation aids—for the improvement of the efficiency of the existing system of control, leading eventually, perhaps, to a revision of procedural and control techniques.

A three-year-plus experimental programme is planned for the Ferranti Apollo digital computer which will be installed at the Scottish A.T.C. Centre this summer. The work there will include the investigation of the best uses to be made of automatic equipment; the standardization and regularization of data flow; the analysis of statistical data; and the determination of the requirements for, and testing of, different types of output and display equipment. The results will be applied progressively in the general development of A.T.C. services.

IN SERVICE.—With Riddle Airlines since the beginning of this year, the Argosy is the first Armstrong Whitworth civil aeroplane to fly on revenue-earning operations for more than 20 years. The first of seven Argosies is here seen in company with one of the C-46s it is replacing.

Accident Investigation and Human Error

ALTHOUGH the main recommendations in the report, published last week, of what has become known as the Cairns Committee* concern the means by which the risk of personal injustices may be reduced, the most important ones are to the effect that the scope of accident investigation should be widened and that more emphasis should be placed on the lessons to be learned.

In its final observations the committee emphasizes these recommendations, remarking that "in the widest interests of air safety, more information should be made available to the interested public, both in the sense of providing more detail about those accidents which are investigated and extending the range of accidents into which inquiry is made. We believe that more recommendations should be included in reports on accidents, aimed at the elimination of all contributory causes which may lead to accidents in the future and the introduction of improvements which can lead to an increase in safety in any aspect of aircraft operation or equipment."

The Committee, presided over by Mr. Justice Cairns, was set up on Nov. 27, 1959, to inquire into the law and practice governing accident investigations and the conditions under which licences and associated privileges may be cancelled, suspended, or varied. The report's 54 recommendations include these:—

The main purpose of an accident investigation is to determine the cause of the accident with a view to preventing similar accidents in the future. This should be stated in the Regulations.

Wherever appropriate, accident reports should refer to previous accidents of a similar nature.

More accidents should be investigated by the Accidents Investigation Branch.

The Accidents Investigation Branch ought also to investigate the more serious incidents.

If the report of an accident investigation is not published, it should be available on demand to any member of the public.

Accident reports should deal with contributory causes as well as the immediate cause and be more detailed; if necessary, technical details should be given in appendices to the report.

The Chief Inspector should be empowered to co-opt experts when he considers it necessary and practicable to form a team to investigate an accident. If the actions of the pilot are likely to be called into question, a pilot with similar experience should invariably be included in the team.

Provision should be made for the setting up of independent Review Tribunals to review the findings of an Inspector's Investigation, at the request of any person or organization having objections to any finding which affects him or it in a draft report.

Provision should be made in the Regulations for the reopening of an Inspector's Investigation if new and important evidence becomes available.

The Court at a Public Inquiry should not be concerned with action on licences or other documents and the power for the Court to make such recommendations should be deleted from the Regulations.

Where the Attorney General is in possession of information which suggests that a high degree of blame for an accident ought to be attributed to some person or organization he should cause written notice of the allegation to be served before the Inquiry.

Aero-medical specialists should participate in accident investigations whenever there is a possibility that useful lessons may be learned.

Provision should be made for the setting up of independent Appeal Boards to consider appeals against licence action.

If it becomes apparent in the course of an accident investigation that a licence holder may endanger others if he continues to exercise the privileges of his licence, the Ministry or the Air Registration Board should be informed.

The report covers a very wide field, with sections devoted to an examination of investigating procedures in other countries and in shipping and railway accidents.

* "Report of the Committee on Civil Aircraft Accident Investigation and Licence Control," H.M.S.O. 4s. 6d.

Cunard Eagle's Atlantic Aspirations

M. J. HARDY *discusses Cunard Eagle's operations to Bermuda and gives an overall picture of this British independent's plans and prospects.*

HALF-WAY back across the Atlantic on Cunard Eagle Flight EB200 from Bermuda, it occurred to the writer that he was sitting in the only British long-haul airliner to be added to an independent airline fleet since the Civil Aviation Licensing Act became law. This was the Britannia 318 G-APYY, originally CU-2-668 "Libertad" of Cubana, which was leased by Cunard Eagle for a period of seven months from Mar. 22, 1960. The lease has since been extended, and will continue as long as is suitable to both parties, while G-APYY will be joined by two more Britannias bought outright from Canadian Pacific Air Lines and due to be delivered in the spring.

Future equipment plans must depend to a large extent on the outcome of applications before the Air Transport Licensing Board, but a Cunard Eagle team is in America looking at current turbine transports, including the Canadair CL-44 freighter. The company expects to start a transatlantic all-freight service in September, using DC-6Cs; it is hoped that the necessary C.A.B. foreign carrier permit will have been awarded by then, approval already having been granted by the Ministry. It is well known that Cunard Eagle hope to be able to compete with B.O.A.C. for North Atlantic passenger traffic, as well as in all-freight services; the company considers that there is a strong case for a second British carrier on this highly competitive route, and that extra traffic will be found to fill the extra capacity put on by a second carrier.

The Cunard partnership with Eagle will obviously be an asset on such a route. Cunard Eagle commenced Britannia Skycoach services on the London-Bermuda-Nassau route on Oct. 10 last, operating every other month alternately with B.O.A.C. Britannia 312s. A fortnightly first/economy service on the same route was inaugurated on Oct. 15, being increased to a once-weekly frequency as from Mar. 4. This service now makes available for the first time a through-plane connection between London and Miami, because the first/economy flights have now been extended to Miami. Cunard Eagle, unlike other British independents, has been allowed a share of first-class as well as economy traffic in its partnership with B.O.A.C.

There are two points of interest about the Bermuda operation. First, the Britannia service is actually operated by Cunard Eagle Airways (Bermuda), Ltd., who charter the aircraft from the parent company, who provide flight and cabin crews. Secondly, the service to Bermuda and Nassau is not operated in pool with B.O.A.C.; the advantages of a pool agreement have, in fact, been looked at by both airlines in the past, but no definite arrangement has so far been worked out. So Cunard Eagle can claim to be the only independent in direct competition with B.O.A.C., without having to share revenues with the Corporation, and although at present both carriers operate the same type of aircraft the competitive situation will change in the Corporation's favour when its 707s start operating to Bermuda.

It is to be hoped that the British industry will in due course benefit by a jet order from Cunard Eagle as a result of this competitive stimulus. For the present, however, it is cabin service and interiors rather than equipment that will influence the passenger; Cunard Eagle's Britannia has accommodation for 91 economy and 18 first-class passengers in an interior essentially similar to that of Cubana's. The first-class seating is removed on the Skycoach services in favour of additional economy seating; forward-facing seats are featured throughout.

Background to the Bermuda Service

The Bermuda Skycoach service is particularly significant because it comes closer than any of the others in this category towards meeting Eagle's very low fare proposals of over two years ago; at £130 the return London-Bermuda Skycoach fare is only £6 above the proposed V.L.F. fare, which was based on the 88-seat DC-6C. Similarly the current London-Nassau return Skycoach fare, at £162, is only £22 above the original V.L.F. proposal which was approved by the Bahamas authorities—again a reasonable differential for the benefits of turboprop travel.

But it should be emphasized that Bermuda was not included in the famous V.L.F. proposals of December, 1958, because on Sept. 15 of that year Eagle's Bermudian subsidiary was granted approval by the Bermuda Government to operate a service from the colony to London. The fare was later approved at £124 return, or £94 less than the B.O.A.C. tourist fare, while initial frequency was to have been four times weekly. The application had been put forward to the Bermuda authorities in October, 1957, and duly approved, but the M.T.C.A. was unable to make a firm decision during 1958 and 1959.

In the end approval from this country was forthcoming, and operation of Skycoach services commenced, three whole years after the original application came before the Bermuda authorities. The proposed £124 fare—which can be regarded as the "prototype" V.L.F.—was, incidentally, arrived at by subtracting the Bermuda-New York return tourist fare from the London-New York return economy fare, but even the current Skycoach fare is now undercut by the 17-day off-season excursion fare of £114 6s. between Bermuda and London. If anything, it is the latter that could undermine Skycoach, rather than this class of cabotage fare, as was once feared, undermining the international fare structure.

The 17-day excursion fare is £40 1s. cheaper than the normal economy fare on propeller airliners, and £85 1s. cheaper than the corresponding jet fare. The first-class fare is £321 10s. for jets or £282 18s. for Britannias. Prior to the inauguration of Skycoach services Eagle had, since December, 1959, operated occasional low-fare DC-6C services to Bermuda at £124 return and to Nassau at £155 return. These complied with the existing legislation in that they were "non-systematic," but they were not group charters, being available to the general public.

No Material Diversion

Because Cunard Eagle's Bermuda operation conforms so closely in terms of fares and equipment, if not in frequency, to the original V.L.F. ideals, there is an especial significance in the question of the extent to which the lower Skycoach fares have caused "material diversion" from existing B.O.A.C. traffic. The answer to this is that little, if any, diversion has resulted, partly because of the low frequency of Skycoach services (which in any case are being operated by B.O.A.C. as well) and partly because of the corporation's long-established lead on the London-Bermuda route. At any rate, Cunard Eagle has had no comments about diversion from B.O.A.C., and the good loads it has been getting on Skycoach services seem to bear out Eagle's original contention that V.L.F. would generate entirely new traffic.

Another factor tending to mitigate any diversionary effects is that the fare structure is more complicated than it was when the idea of V.L.F. was first put forward. It will not be until the early summer, after 17-day excursion fares have ended, that Skycoach's diversionary effect, if any, will begin to be felt; this effect will be minimized by the introduction of Boeing 707-436s on B.O.A.C.'s first/economy services through Bermuda to Bridgetown, Port of Spain, Caracas and Bogota.

At present, however, it might seem as if Skycoach is being "unsold" by the 17-day fare because of the much greater frequency of economy services and because these are not restricted to British residents. Because the coming of Skycoach services was known to the public much further in advance than the 17-day fare, and because of the former's low frequency, prospective Skycoach passengers had to make their plans at least a month in advance, and usually several months, with the result that this class of fare has not in fact been unsold by the 17-day rate.

It might also be thought that Bermudians, in a holiday resort with a high standard of living and an equable climate, with no income taxes, no death duties and no public debt, would have little need of Skycoach services. Tourism is a very important industry to the West Indies in general, and to Bermuda in particular; about 70% of the colony's income is derived from the tourist trade. Bermuda's especial problem is how to sustain its tourist business in the off-season months of December, January and February, when more British tourists would be welcome; the tourist season starts about mid-March.

There is also a demand from Bermudians themselves for

(*Continued on page* 255)

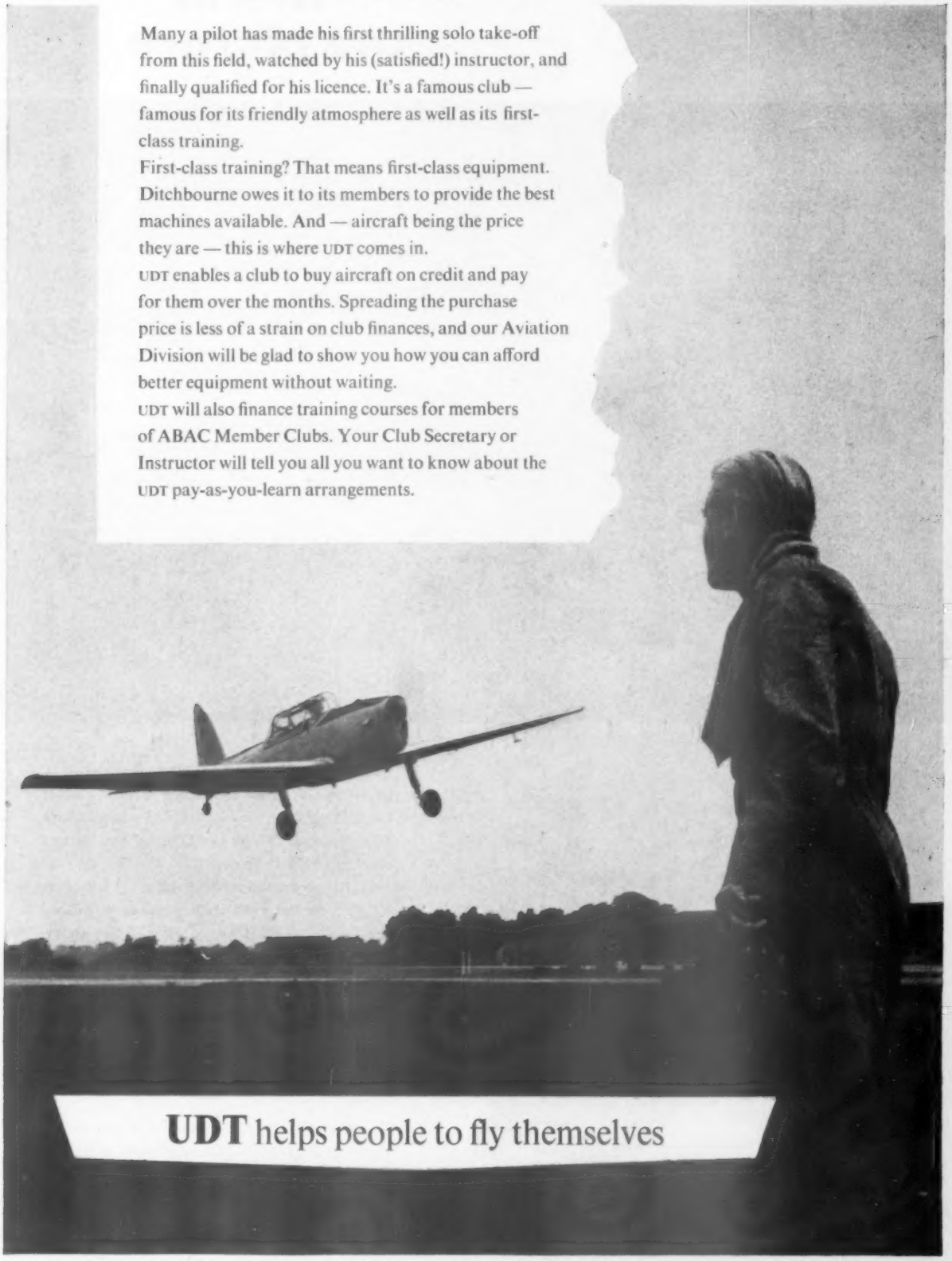
Ditchbourne Flying Club buys a trainer

Many a pilot has made his first thrilling solo take-off from this field, watched by his (satisfied!) instructor, and finally qualified for his licence. It's a famous club — famous for its friendly atmosphere as well as its first-class training.

First-class training? That means first-class equipment. Ditchbourne owes it to its members to provide the best machines available. And — aircraft being the price they are — this is where UDT comes in.

UDT enables a club to buy aircraft on credit and pay for them over the months. Spreading the purchase price is less of a strain on club finances, and our Aviation Division will be glad to show you how you can afford better equipment without waiting.

UDT will also finance training courses for members of ABAC Member Clubs. Your Club Secretary or Instructor will tell you all you want to know about the UDT pay-as-you-learn arrangements.



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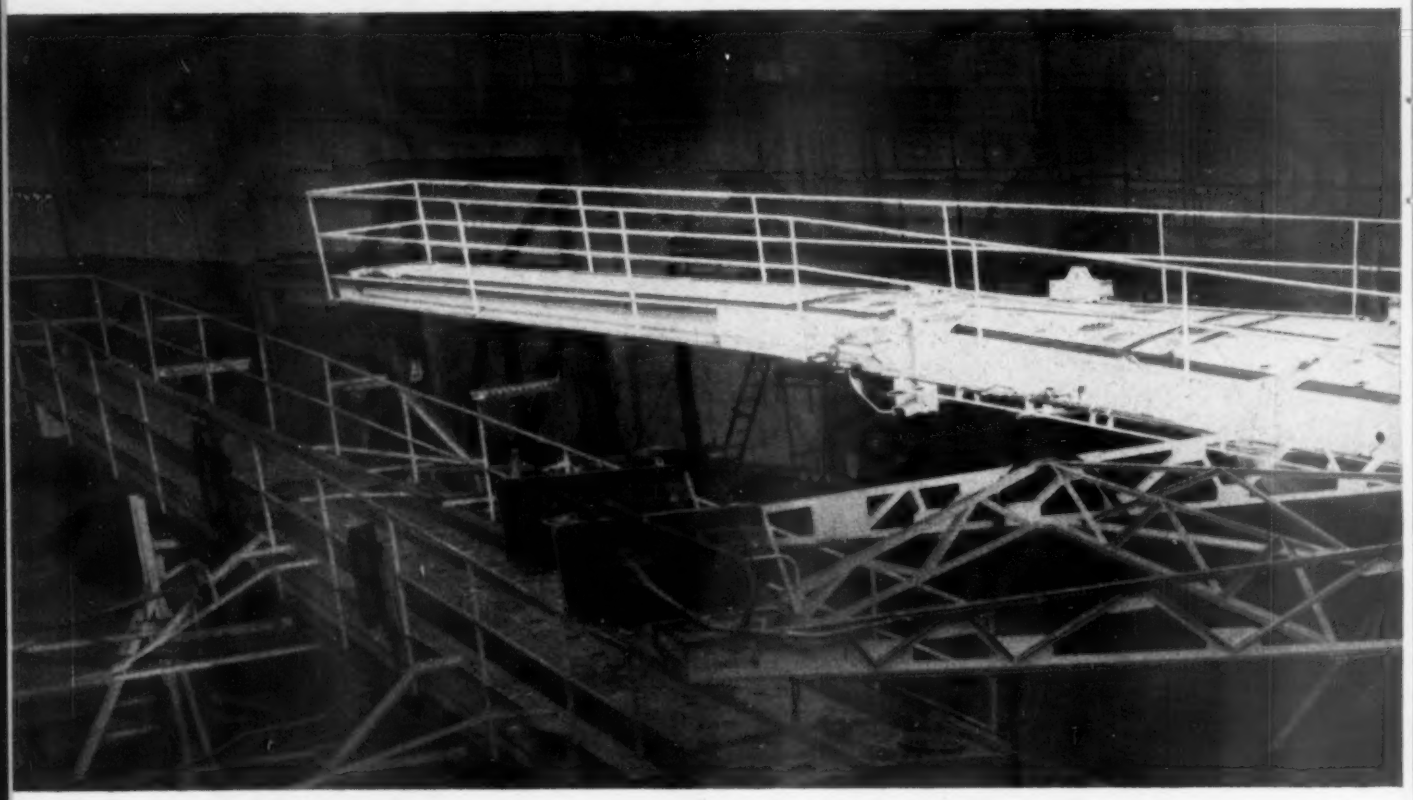
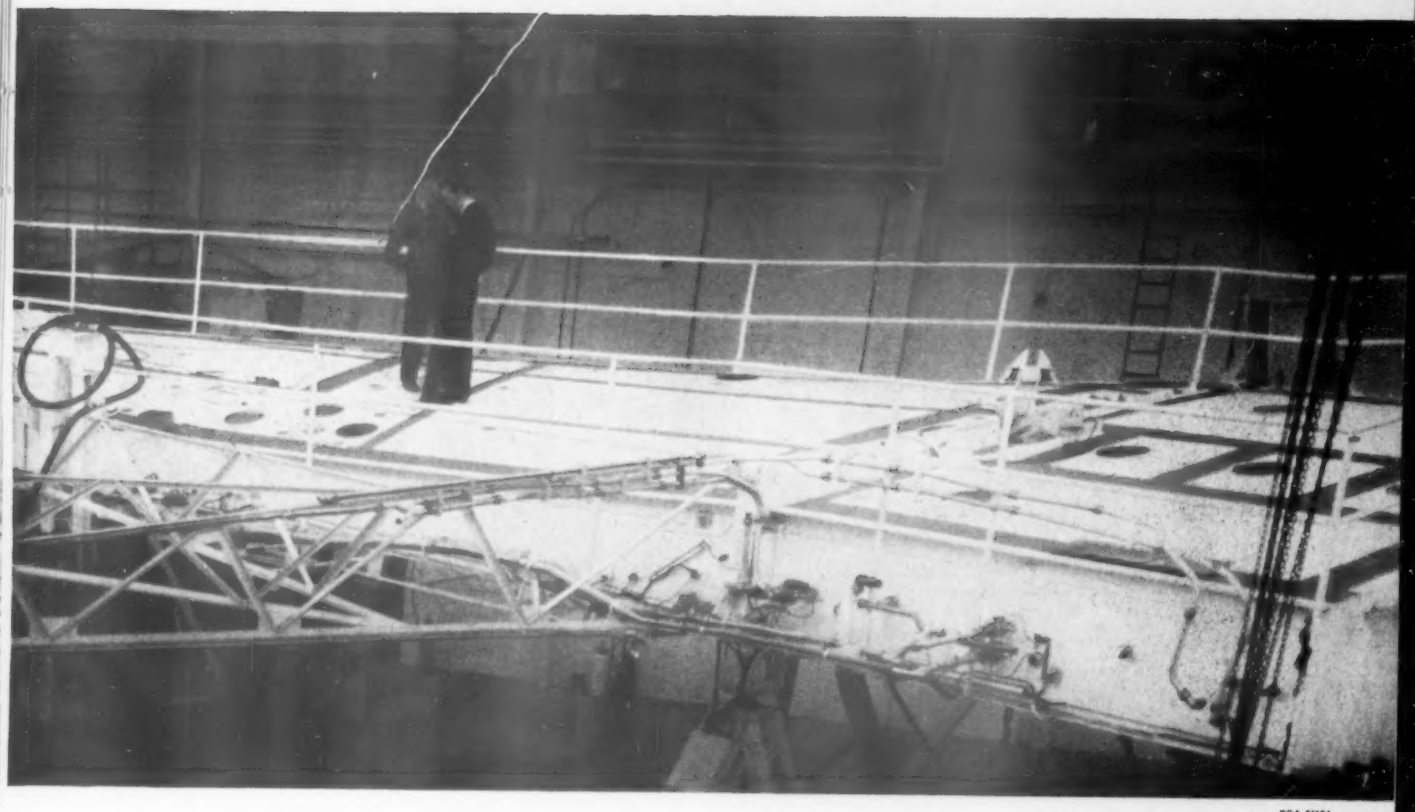


This is one of seven indicators in the VC.10 fuel load control panel which enable any desired weight of fuel to be selected for the tank concerned. These gauges automatically control fuel load in their respective tanks to pre-set quantities.

The Smiths Waymouth Type 4 transistorised fuel contents gauging system is fitted for testing purposes to this full scale replica of a Vickers VC.10 port wing and centre section built at Weybridge. The Waymouth system has been specified for all production VC.10's to date. It incorporates a unique fuel load control panel located in the underside of the port wing, from which ground crew will be able to control accurately the entire fuelling operation, with overloading automatically prevented. The highest fuelling rate ever achieved—1,000 Imperial gallons a minute—enables the VC.10's thirst to be slaked in some seventeen minutes.

To all in aviation, Smiths—a name with a world of meaning—means service in instrumentation, from drawing board to installation . . . and beyond. Whatever the instrument problem; fuel measurement, flight control, engine or navigation, call in Smiths to put you in the picture.



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The *Armstrong Whitworth Argosy C Mk. 1 for the Royal Air Force Transport Command will be fitted with Marconi AD2300B Doppler Navigator and Track Guide Computer.

** They will also be fitted with the Marconi AD712 Automatic Direction Finder.*

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(*Continued from page* 254)

travel to Europe. For some time prior to the start of Cunard Eagle's Britannia operations there had been a strong body of opinion in the colony that B.O.A.C.'s services to the U.K. were inadequate from the viewpoints, in particular, of frequency and cheapness.

Fares to London were felt to be too high, services routed through New York were inconvenient, and although the Corporation had scheduled more capacity through Bermuda it had added more and more points beyond such as Caracas and Bogota, with the result that Bermudians themselves found it difficult to get seats on flights to this country.

Bermuda—with Kindley Field and, beyond it, Castle Harbour.

Growth of the Bermudian Subsidiary

The Colony's viewpoint that it was, perhaps, being regarded more as a staging post by the Corporation than as a traffic stop of real importance in its own right, and also Bermuda's long tradition of being very much a colony that has looked after its own affairs, provided a fertile soil for the growth of Cunard Eagle's Bermudian subsidiary, which was registered on Jly. 26, 1957. Cunard Eagle Airways (Bermuda), Ltd., has expanded from a once-daily Viscount 805 service (started in May, 1958) to New York to three Viscount 707 services a week last summer, plus one a week through New York to Baltimore and Washington, another to Montreal, and another from Bermuda to Nassau.

This expansion has been achieved in spite of jet competition from Pan American 707s and now DC-8s on the New York route (the airline now operates a daily jet service), with the prospect of further jet competition from B.O.A.C. 707s and Trans-Canada Airlines' and Eastern DC-8s. The two last carriers currently operate Super Constellations and DC-7Bs to Bermuda from Washington, New York, Toronto and Montreal, while B.O.A.C. competes with Britannias. PanAm also uses DC-7Cs both direct from New York and through Boston, while Eastern has just added Philadelphia and Washington as intermediate stops on some of its Bermuda services. T.C.A. is to replace its L-1049s with Vanguards from Apr. 1.

The table below shows how Cunard Eagle has improved its share of traffic on the highly competitive routes to the States, operating against airlines established for many years in these markets. Figures for T.C.A. are not included because the Canadian airline does not link Bermuda with the U.S.A. The 1960 total will almost certainly show a decline in Cunard Eagle's rate of growth, for Pan American commenced 707 services between New York and Bermuda on Dec. 17, 1959.

The feat of doubling the number of passengers carried in its second year of operation is due not least to Cunard Eagle's (Bermuda) use of promotional fares and package tours. The normal tourist return fare to New York is $105, but the fare

	No. of Passengers Arriving at and Departing from Bermuda			
Year	PanAm	B.O.A.C.	Eastern	Eagle
1959	93,694	37,046	42,632	21,015
1958	95,058	32,325	51,430	10,297
1957	106,256	28,060	41,297	—
1956	81,124	31,512	41,139	—
1955	83,401	38,656	36,143	—

Source: 1959 Report of the Bermuda D.C.A.

on Cunard Eagle "Sunset Flights" departing at 5 p.m. and after is $20 less. There is a good deal of I.T. and package tour business in the summer on the New York-Bermuda route; two nights in New York with a couple of Broadway shows thrown in is a popular "package."

Last October, IATA carriers at Cannes, including Cunard Eagle (Bermuda), agreed on new family fares between Bermuda, the U.S.A. and Canada providing a third discount for each additional member of the family group. New special commodity freight rates between North America and the Caribbean were also agreed, and one type of cargo that should benefit from these rates is the Bermuda Easter Lily. The buds of this fragrant flower—which is about the only thing exported from Bermuda—are air-freighted to the U.S.A., Canada and England.

Viscounts will be uncompetitive before many years between New York and Bermuda, and faced with increasingly strong jet competition on a route which is very important to the colony's economy and which at present is dominated by Pan American and Eastern, it would not be surprising if an "interim" jet were to be acquired by Cunard Eagle Airways (Bermuda) to maintain its competitive position. But it should be emphasized that there are no immediate plans for jet re-equipment, either by the Bermudian subsidiary or by the parent company. Neither Tridents nor VC-10s could be available before 1964-65, and it is this consideration that doubtless led Eagle to list the 707 and DC-8 as types which it might operate if awarded the London-New York route for which it has recently applied to the Air Transport Licensing Board.

The Comet 4C should be very suitable for the New York-Bermuda route, especially by virtue of its delivery dates, while a more distant, but intriguing, possibility is the operation of Cunard Eagle Tridents on this route in direct competition with Eastern's Boeing 727s. This possibility is perhaps not so unlikely in view of the Bermuda Government's desire to see a greater British and Bermudian share of the traffic on this route, and the additional financial backing which the link-up with Cunard makes possible.

Cunard Eagle Airways (Bahamas), Ltd., already operates four services a day with Viscount 707s chartered from its Bermudian associate between Nassau and Miami in competition with the three flights a day of Bahamas Airways. Mackey Airlines, Inc., also operates two DC-4 services daily between Fort Lauderdale, Fla., and Nassau, while PanAm provides the strongest competition with one DC-8 or 707 service plus two DC-6B or DC-7C services a day covering the 189 miles between Miami and Nassau. The Bahamas are very popular among American holidaymakers in Florida who like to make the trip to the islands, and Cunard Eagle's Viscount 707s seat up to 63 passengers—a high density which reflects the considerable tourist potential.

North Atlantic Services

Last June, Cunard Eagle applied to the A.T.A.C. to operate transatlantic all-freight services at an initial frequency of two return flights weekly increasing to daily flights later, using DC-6Cs. The U.K. terminals proposed were London, Manchester and Glasgow, and in North America, New York, Boston, Detroit, Chicago, Philadelphia, Washington, Baltimore, Montreal and Toronto. A similar application, specifying a wider range of equipment, was put in by B.O.A.C. at the same time, and both these applications have since been approved by the Minister. The Corporation's DC-7Fs are now operating freight services to New York, while C.A.B. approval for Cunard Eagle is not expected to present any difficulties. B.O.A.C. will not operate in pool with Cunard Eagle when the latter starts its freight services.

These have been rather overshadowed by Cunard Eagle's more recent application—the very first to be lodged with the Air Transport Licensing Board—to operate between London and New York carrying passengers, supplementary freight and mail. Britannias would be used initially, and big jets later; the American destinations listed in the application are in fact the same as for the transatlantic freight service, while the U.K. points are London, Manchester or Prestwick.

If the board, in the face of B.O.A.C.'s opposition, does license Cunard Eagle for this route, it will be interesting to see how U.S. airlines will react to the prospect of a second British carrier—particularly airlines like Eastern who are affected by the competition of Cunard Eagle's Bermudian and Bahaman subsidiaries. Certainly Cunard Eagle's excellent

relations with the Bermudian and Bahaman Governments entitle it to regard these islands as strong bargaining counters in the traffic rights game, whilst the prestige of Cunard should also be a useful asset—and more particularly the integration of ticket-selling facilities that such a shipping association could eventually bring. The U.S.-U.K. air agreement does not limit the number of carriers that may be designated on any route nor do the Americans insist on capacity or frequency limitations, so Cunard Eagle should have plenty of scope for future expansion on the North Atlantic if its application is granted.

In conclusion it is worth emphasizing how Cunard Eagle's New York application and British United's African and European route applications reflect the current trend among the major independents away from price competition towards quality competition, possibly because the latter may be more acceptable politically. It will certainly be very interesting to see if this trend continues; will the independents continue to regard low-cost air transport as typified by the V.L.F. proposals as of real importance in its own right, or will they, with an economically workable route pattern resulting from A.T.L.B. awards behind them, tend to look back at V.L.F. as a channel for their frustrated energies and talents when legislation and protectionism did not allow them to operate in direct competition with the Corporations?

Perhaps the newer independents like Overseas or Tradair will challenge the older independents and the Corporations in years to come with ideas for cheaper travel as revolutionary as V.L.F. was in its day. Perhaps a still more interesting question is the extent to which the British industry will benefit from independent orders under the A.T.L.B.'s regime—orders which might one day include that long-awaited vehicle, the airliner specifically designed to operate as cheaply as possible.

Implications of the Cargo-rate Breakdown

JOHN W. S. BRANCKER, *traffic director of IATA from* 1953 *to* 1960, *discusses the possible benefits and dangers for the airlines of North Atlantic cargo-rate competition.*

SINCE the IATA airlines showed a firm determination in Paris to disagree about North Atlantic cargo rates—after due warning at Cannes in 1960, but without undue attention to collective facts and figures which do not appear to have been available—a somewhat interesting situation arises.

A lot has been said, and a great deal written, about the much-heralded "break-through" (whatever that may mean) in cargo, and it now looks as though this will take the form of a number of individual attacks, on the lines of a mediaeval battle, by individual knights on horseback. Each will shout his own war cry, but most of these will, I suspect, be somewhat similar: "We wanted the lowest rates! Send your freight by B.O.A.C. (or P.A.A., Seaboard and Western, etc., as the case may be)."

This may well produce a greater impact, in the first instance, than an organized attack with more orthodox weapons; it will at least startle the enemy—presumably the shippers, who are unaccustomed to this sort of offensive and may find their defences weak. The real question is: for how long can the offensive be sustained?

A great deal of the extra cargo capacity which will become available on the North Atlantic in 1961 is not exactly the result of deliberate planning. In the case of some airlines this remark is untrue, but to a great degree this capacity represents a combination of that automatically made available under the cabin floors of the jets, and of the need for using piston-engined aircraft which have ceased to be competitive in the passenger field, but which are not yet fully obsolesced. This situation is not perhaps wholly unfortunate, because the airlines, having hovered about for a number of years on the brink of the cargo swimming pool (while the boldest paddled a little shyly in the shallow end), have now been tipped into the deep water.

Whether they go down or stay on top will depend not only on their individual competence in swimming, but on their skill in avoiding being pulled down by the non-swimmers, on the availability of any lifebelts in the way of government assistance, and ability to stand a period of loss.

The important question, of course, is whether the industry will benefit in the long run, and this is not, at present, a very easy one to answer. It may be clearer if we try to define the ultimate objective. I suggest that this might be described as the expansion of the cargo market to the greatest extent possible compatible with sound economics.

This, I think, inherently implies the carriage of cargo on a basis which is not limited in any way by the space which may or may not be available in passenger aircraft. It definitely calls for the use of all-cargo aircraft—and by that I mean aircraft which have been specifically designed to carry cargo and not conversions from obsolescent passenger equipment. The reasons for this are fairly clear. If an intelligent rating system is adopted, the volume will increase enormously, and the belly-holds of passenger aircraft, however cavernous they appear today, will be quite insufficient for the flow.

All-cargo aircraft will, therefore, become essential because it would be wholly absurd to offer a service which cannot be fulfilled. Converted aircraft may be a stop-gap, but they cannot yield the right cost figures, if used wholly on their own, to produce the maximum flow, so that the longer they remain in service the more money they will tend to lose—or alternatively they will prevent the right rates from being applied.

The danger of the present situation seems to lie in two directions.

The airlines have never shown very much determination, in the face of competition, to hold cargo rates at the level which the traffic can bear. There has always been a tendency, quite natural perhaps in the circumstances, not only to introduce commodity rates which have not been very wisely considered, but also to encourage shippers to use the lowest rates which a fertile imagination has appeared to make legally applicable. If, against a background of unfilled cargo holds, and unknown but suspected competition, they debase the rates to a level below the economic requirements of an all-cargo aircraft, they will put themselves into the difficult position of either having to refuse traffic or to carry it at a loss. And it is not going to be either easy or popular to put rates up again.

If, on the other hand, they base their rates at the level required by passenger aircraft which have been converted to the carriage of cargo, these rates will be too high to produce the volume which is required—unless they manage to suppress their accountants and deliberately stand into a controlled loss.

Free competition is probably an excellent thing, provided it does not get out of hand, and only the future will show whether this will happen. Mention has been made of possible Government intervention in the event of a rate war, but this may be difficult, because, although it is easy to compare passenger fares, it is nothing like so simple to compare different cargo scales, including breakpoints and a host of different commodity rates. Furthermore, it is by no means certain that, in the realm of cargo, the war will show on the surface.

There is one thing which the carriers may have forgotten, but which they would do well to bear in mind. From the point of view of the shipper, low rates are obviously desirable—but so are stable rates. If you start quoting C.I.F. (cost, insurance and freight) prices, it is nice to know that they will not have to be altered at short notice; it is also nice to know that your competitor cannot underquote you by finding a more resilient airline.

It is quite possible that, by experimenting freely, the carriers will discover, by trial and error, rating systems which will generate the required volume at revenue levels which can be economically maintained in the future, regardless of the volume of traffic handled. If they can do this, and can avoid a battle to fill empty space without regard to the rates offered, it will be a major step forward. It may even show, in fact, that it is not essential for the same kind of rating system to be applied by all carriers, provided that one is not destructive of the others. Such an arrangement would not necessarily be fatal to the industry, although it would give rise to some complications, and the shipping agents would have a busy time comparing tariffs.

There would also be an inherent tendency for all rates to gravitate to the lowest level.

Another interesting question is: What effect is the present situation likely to have on the purchase of all-cargo aircraft—which must be the key to the development of cargo traffic on a long-term basis? Will the probable lack of stability in the field of rates make carriers even more reluctant to invest capital in cargo equipment, or will they have the courage to see that, whatever may happen in the next year or so, the ultimate solution must lie in this action? In all probability, most carriers will wait to see what develops and will carry on with present equipment until more valid signs of future stability can be seen.

At all events the next few years will be interesting.

The Fighting Services

Air Rank Changes

AIR MARSHAL SIR EDMUND HUDLESTON, K.C.B., C.B.E., the Vice-Chief of the Air Staff, has been promoted to the rank of Air Chief Marshal.

Air Cdre. J. C. Millar, D.S.O., formerly Director of Flight Safety at the Air Ministry, has become Commandant of the Central Signals Establishment. He was Chief Signals Officer at Bomber Command in 1954.

Third Commission Completed

LAST week the aircraft carrier "Ark Royal" returned to her home port of Devonport at the end of her third general service commission. During this 15-month period, the 43,000-ton carrier steamed 80,000 miles and was at sea for 56% of her time away from the United Kingdom.

Much of the commission was spent in Mediterranean waters, where she exercised with the U.S. and French fleets, the R.A.F., U.S.A.F. and army units. She took part in the autumn NATO exercise "Swordthrust" in the Norwegian sea area, and spent 10 days in the Davis Strait, west of Greenland, undertaking cold weather flying trials. These were followed by further exercises with U.S. and Canadian aircraft.

Operating Scimitar F.1s, Sea Vixen FAW.1s, Gannet AEW.3s and Whirlwinds, the carrier's squadrons logged 8,500 sorties, of which 450 were at night. In addition to free take-offs, including 3,000 helicopter flights, the "Ark Royal's" steam catapults made 2,400 Scimitar, 1,100 Sea Vixen and 400 Gannet launches.

A Year of Service

THIS month marks the end of the first year of fully operational service by the new F.E.A.F. staging post on the island of Gan in the Indian Ocean. During this period the station, a replacement for Katanagake in Ceylon, turned round some 630 aircraft and handled 12,500 passengers and 1,500,000 lb. of freight.

When the Command's staging commitment passed to Gan in January, 1959, transfer of servicing equipment from Katanagake began by sea and air. At the peak of the airlift, which took place between June, 1959, and February, 1960, 500,000 lb. of equipment and stores a month were air freighted to the island by F.E.A.F. Beverleys, Bristol Freighters and Hastings. Altogether, some 5,000,000 lb. of equipment was flown in during this period.

The only operational aircraft permanently stationed on Gan —for search and rescue duties—are two Shackletons of No. 205 Squadron from R.A.F. Changi, Singapore. The Gan Rescue Co-ordination Centre, now being enlarged and rebuilt, covers one of the biggest search areas in the World. Its commitment extends in an oblong from Karachi to Calcutta in the north throughout the whole length and breadth of the Indian Ocean towards the South Pole.

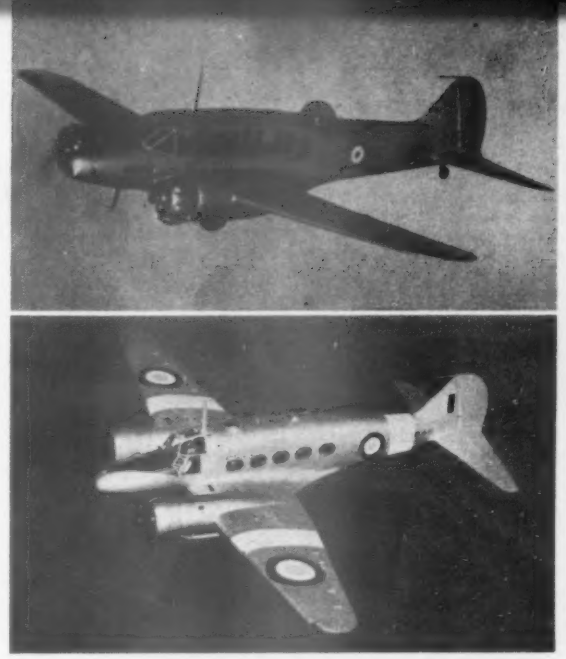
Main regions of responsibility covered by the two Shackletons detached to Gan from Singapore lie in the area from Gan to Changi in the east, and to Aden and Nairobi in the west, with a commitment also to keep an eye on the Qantas and South African Airways routes from the Cocos Islands to Mauritius.

Still Going Strong

AN anniversary worth noting which occurs within the R.A.F. this month is that it is now 25 years since the Avro Anson was introduced into service. No. 48 Squadron based at Manston received the first examples of this type, then a general reconnaissance machine, on Mar. 6, 1936. Today, in not such a vastly changed form, the Anson is still giving sterling service as a light transport and communications aircraft.

When the first Ansons were delivered to Coastal Command they represented something entirely new. Nowhere within the Service was there a squadron flying monoplanes nor yet an aeroplane with a retractable undercarriage. Its operational life was to be a short one, however, as by the start of World War 2 Lockheed Hudsons, with their superior range and speed, were beginning to take over the task of maritime reconnaissance. Nevertheless a small number remained with Coastal Command until 1942.

It was as a trainer that the Anson really came into its own. Plans for this version had been in hand since 1935 but it was not until 1939 that production got under way with an order for 1,500. Along with a large number of the reconnaissance type disestablished by Coastal Command they served the War as navigational, wireless and armament trainers while the Oxford was used for pilot training.



FIRST AND LAST.—K 6152 (top), the first production Anson Mk.1 and WJ 561, a T.21, the 11,020th Anson built. This aircraft was delivered to the R.A.F. on May 27th, 1952.

With the setting up of the Commonwealth Air Training Plan in 1939 the Anson was chosen as one of the standard training types. A total of 223 were shipped to Canada to be fitted with Jacobs and Wright radial engines to form the nucleus of many training schools until production of the type was started on that side of the Atlantic.

Many thousands of hours have been logged since 1945 by the Anson, affectionately known as "Faithful Annie," on training and communications flights. Only three marks now remain in service all of which have been produced post-war; the C.19, a military version of the Avro XIX feeder-liner, the T.21 and the C.21, a communications conversion of the T.21. Of the 11,020 Ansons built, 8,138 of which come from British factories, it is estimated that some 200 still remain in R.A.F. service.

These are in use with communication and station flights. Since no suitable replacement type is as yet forthcoming from the aircraft industry and as production of the Devon and Pembroke has ceased with only a combined total of some 80 or 90 for the R.A.F., it would seem likely that the Anson's familiar drone will be heard for a good many years to come.—R.S.H.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. G. C. Lamb, A.F.C., and Wg. Cdr. S. McCreith, A.F.C., to the Department of the Air Member for Supply and Organization.

Bomber Command: Wg. Cdr. T. Stevenson, A.F.C., to Headquarters Unit to command; Sqn. Ldr. S. G. Tatem to Headquarters, No. 3 Group, as Chief Signals Officer, with acting rank of Wg. Cdr.

Fighter Command: Wg. Cdr. K. W. Haynes to Headquarters for electronics planning duties.

Transport Command: Wg. Cdr. F. E. Lord, A.F.C., to R.A.F. Lyneham to command the Administrative Wing; Sqn. Ldr. T. R. I. R. Sanceau to Headquarters for equipment duties, with acting rank of Wg. Cdr.

Technical Training Command: Sqn. Ldr. J. J. Deverill to R.A.F. Bircham Newton for staff duties, with acting rank of Wg. Cdr.

Other Appointments: Wg. Cdr. P. E. Mitchell to Aldermaston.

More Service News

No. 194 Squadron Reunion.—The 11th reunion dinner of No. 194 Squadron will be held at the Mapleton Restaurant, Coventry Street, Piccadilly, London, on Saturday, Apr. 15. Tickets, price £1 each, may be obtained from Mr. Douglas Williams, 56 Mottingham Lane, Lee, London, S.E.12.

No. 46 Squadron Reunion.—The 44th officers' reunion dinner of No. 46 Squadron will be held on Apr. 22, with the traditional ladies' luncheon on the following day. Further details may be obtained from Sqn. Ldr. P. Gifkins, R.A.F. Linton-on-Ouse, York.

C.F.S. Dinner.—This year's reunion dinner of the Central Flying School Association is to be held in the Officers' Mess, R.A.F. Little Rissington, on Friday, Jly. 14. Full details will be circulated to all members of the Association in due course by the honorary secretary, Flt. Lt. G. M. Phillips.

Hawker Siddeley's Communication S

New details of the design study give
British "Industry and Space"
prepared by Hawker Siddeley Aviat

OF the several schemes published last week by Hawker Siddeley and SEREB in their comprehensive report, "Industry and Space,"* none is more advanced than the design study for a stabilized station-keeping communication satellite which has been produced by the Astronautics Section of the Advanced Projects Group of Hawker Siddeley Aviation, under Dr. W. F. Hilton. First details of this project study were published in this journal last year (Aug. 12, pp. 182-184) in an exclusive article by Dr. Hilton himself.

In the six months since this article appeared, a considerable amount of design development has taken place which has led to a completely new configuration for the satellite. This has served both to increase the overall efficiency of the satellite system and to achieve an all-round functional simplicity commensurate with the problems of an Earth-orientated vehicle.

The completeness of the design approach is apparent from the drawing on this page which illustrates the disposition of the satellite's principal components. Operation is based on the use of four satellites travelling in elliptic orbits inclined at 63.4° to the Equator, and ranging from 300 miles to 12,500 miles above the Earth (Fig. 1). The principle of this orbital arrangement was explained in detail in the issue of Aug. 12, last.

Structural Design

In designing the satellite's structure to contain the various systems, environmental conditions both during launching and in orbit must be considered. The structure basically consists of two major parts, the solar cell array and the instrument canister.

The size of a solar cell array is dictated by the power requirements and whether the array is fixed or sun-seeking. With the fixed array chosen the total area of solar cells is about 230 sq. ft. and this has been divided up into eight panels of approximately 28 sq. ft. each. The total extended length of the array is about 17 ft. A rather neat arrangement for folding the solar cell panels enables the complete satellite to be contained in a cylinder of about 4 ft. 6 in. diameter and 12 ft. in length (Fig. 2).

Although space environmental conditions would suggest a very lightly stressed structure, launching conditions of perhaps 10 *g.* axial and 1.5 *g.* lateral accelerations impose more stringent stress requirements.

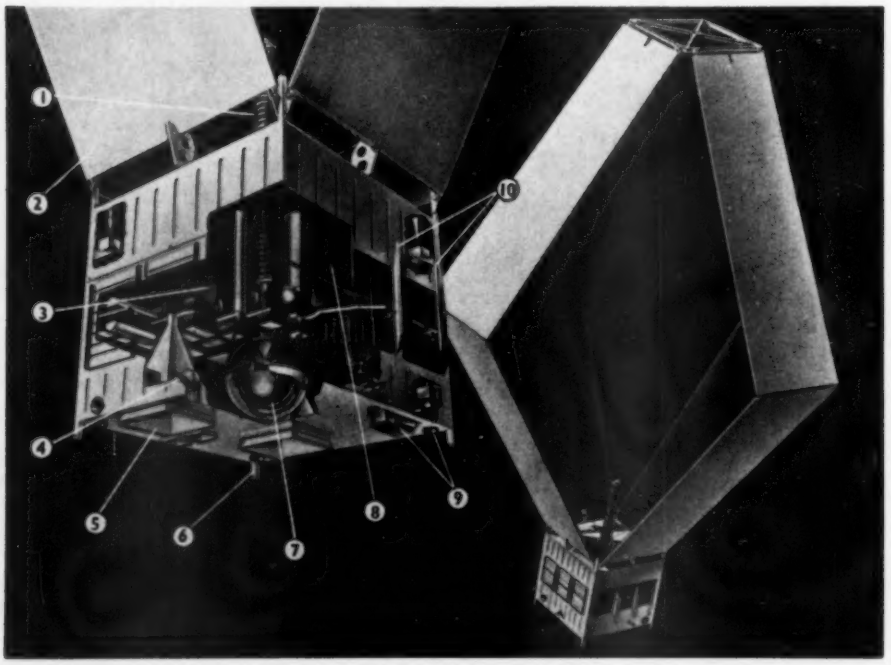
The solar panels themselves consist of solar cells shingled in groups attached to a lightweight honeycomb base which provides a stiff backing structure. The hinges are integral parts of the panel structure which is in tension when subjected to the launch acceleration. The erection of the array from the folded position is initiated by the severance of a cable which allows a central compression spring mounted on the canister to extend.

One end of the spring provides a turning moment to the lower panels via a pulley and cable system while the other end provides an upward force extending the array. The spring is designed to overcome the hinge friction and panel inertia only and the cable system ensures a turning moment to the lower panels throughout the array displacement. When the array is fully extended, spring-loaded plungers lock it in this position.

As can be seen in the drawing, the equipment canister is basically a rigid framework having strong points at the lower four corners for attachment to the final stage of the rocket booster. The equipment is carried internally on a central honeycomb frame attached to the main vertical members. The frame is designed according to strength and thermal requirements and to its perimeter is attached part of the canister covering, possibly of light alloy sheet. The thermal control shutters are attached to this external sheeting. The rest of the canister is covered with panels which can be easily removed for access to the interior. Mounted on the central frame is the spring-retaining tube for the solar cell erection, the spring being retained around this tube when fully expanded.

The satellite is attached to the booster by means of four explosive bolts which form a part of the satellite structure. When the electrical connection is made prior to launching, the explosive bolt mechanism is automatically armed. It is intended that the outer casing enveloping the satellite in the nose of the final stage should be jettisoned, possibly after second-stage cut-off. The final stage and satellite payload will then be injected into orbit, whence separation will occur. (An explosive cutter severs the solar cell panel retaining cable, allowing the array to extend.)

* "Aerospace—A Franco-British Approach," THE AEROPLANE AND ASTRONAUTICS, Mar. 3, 1961, pp. 223-4.



This drawing by Mr. E. Claydon of Hawker Siddeley Aviation's Advanced Projects Group shows the disposition of equipment in the proposed Communication Satellite, and at right, an impression of the complete vehicle as it would appear in orbit with the solar cell panels extended.

Key: 1. Solar cell erecting mechanism; 2. Solar cell panels; 3. Radio equipment; 4. Infra-red sensors; 5. Aerials; 6. Final stage attachment points; 7. Attitude stabilization propellent tank; 8. Batteries; 9. Attitude stabilization nozzles; and 10. Thermal control shutters.

atellite

n in the Franco- report jointly ion and SEREB

Sir Roy Dobson, managing director of the Hawker Siddeley Group, with M. F. Vinsonneau, deputy general manager of SEREB.

Attitude Stabilizer

The satellite's reaction system has been designed to produce control torques at two orders of magnitude. First, there is a relatively high level of separation torques for the brief separation phase, followed by a succession of much smaller torques throughout the remainder of the active life of the satellite.

In order to carry out this requirement most economically, a high-pressure nitrogen source is employed to supply thrust at separation and then subsequently to pressurize the propane system which is used thereafter. The nitrogen, at from 3,500-4,000 lb./sq. in., is contained in a lightweight vessel with a burster membrane, which is punctured by means of a cartridge-operated valve. The pressurized nitrogen then flows in two directions, first through a pressure-reducing valve to the solenoid valves governing the operation of the separation torque nozzles, and secondly to the propane reservoir via a pressure-reducing valve. After the initial separation phase, the nitrogen flow to the separation nozzles is switched off.

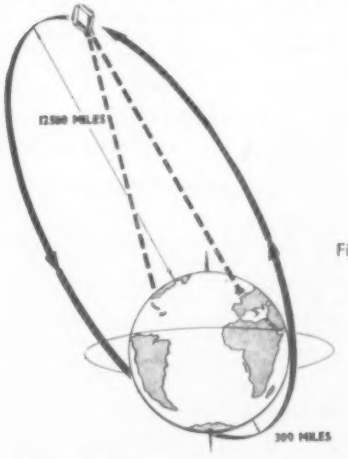


Fig. 1.—Satellite in 63 inclined slot.

The choice of propane was made primarily for its ready volatility and stability compared with H.T.P. The propane reservoir is kept at a constant pressure of 350-400 lb./sq. in. by means of the pressurized nitrogen which is kept separated from the propane by a plastic diaphragm. The flow of propane to the gas system is controlled by an injector of a variable-displacement type, the displacement being varied in accordance with information obtained from a gas pressure transducer in the gas system. Heat for the vaporization of the propane is provided from the four travelling wave tubes (in the communication system) via lithium compound heat sinks. It is expected that the heat output will be about 60 W.

It is proposed to regulate the temperature of the gaseous propane to between 90° and 100° C. When the demands of the system reduce the pressure to a predetermined level, a valve will operate to introduce propane from the reservoir; thus the pressure of the propane delivered to the nozzles will always be at the correct pressure and the thrusts obtained of the correct magnitude.

A blow-off valve in the system will prevent excessive pressure build up.

The proposed reaction system is shown diagrammatically in Fig. 3, and indicates for one channel the electronic system envisaged. It is intended to stabilize the satellite in pitch and yaw leaving it free to spin about its axis of symmetry.

Broadly, the system can be divided into the sensor and control sections. The former comprises an infra-red sensor employing a rotary scanner sensitive only to the Earth's self-emitted radiation, thus allowing the horizon, and hence the local Earth vertical, to be determined.

A phase reference generator would provide information on the position of the satellite's axis and comparison would be made of Earth vertical and satellite axes. The output of the unit via

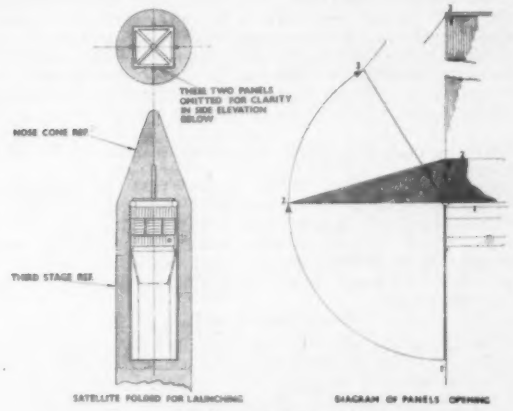

THESE TWO PANELS OMITTED FOR CLARITY IN SIDE ELEVATION BELOW
NOSE CONE REF
THIRD STAGE REF
SATELLITE FOLDED FOR LAUNCHING
DIAGRAM OF PANELS OPENING

Fig. 2.—Satellite opening mechanism.

an emitter follower is an error signal. This signal, which may be either positive or negative with respect to a predetermined convention, is fed to a non-linear controller which sums it until it has reached a predetermined value. At this value, a relay is operated which actuates two propane solenoid valves allowing gas to flow to the jets.

Temperature control

In space, owing to the lack of atmosphere, the transference of heat is mostly by radiation, although conduction within the material in the satellite will occur. The sources of heat to which the satellite is exposed are radiation from the Sun and the Earth, and the internal heat generated by the electronic equipment.

In the Hawker Siddeley proposal, the satellite's temperature control system takes the form of a system of hinged shutters, the outside surfaces of which would be coated with a white lead carbonate paint having the property of low solar absorptivity and high surface emissivity. It is considered that such a paint correctly specified could have values of 0.05 and 0.95 respectively.

The whole of the outer canister surface, apart from the shutters, would also be treated in this manner. The shutters are operated by means of the differential exposure property of a bi-metallic strip and when open reveal black surfaces with

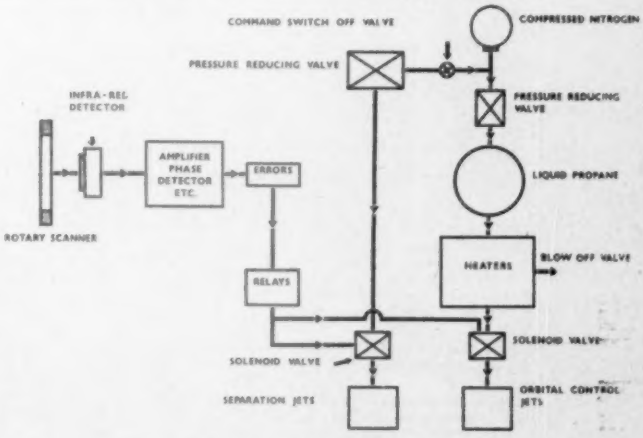


Fig. 3.—Attitude control system.

The Press conference held jointly by Hawker Siddeley and SEREB at the Dorchester on Feb. 28. At the table are, left to right, Mr. G. T. Coates, Astronautics Section, Advanced Projects Group, Hawker Siddeley Aviation; Mr. H. R. Watson, aerospace director, Sir W. G. Armstrong Whitworth Aircraft; M. F. Vinsonneau, deputy general manager of the French organization SEREB; Sir Roy Dobson, managing director, Hawker Siddeley Group; Mr. Stuart D. Davies, technical director, Hawker Siddeley Aviation; Dr. W. F. Hilton, head of Astronautics Section, Advanced Projects Group, Hawker Siddeley Aviation; and Mr. C. R. Turner, Astronautics Section, Advanced Projects Group, Hawker Siddeley Aviation.

radiative properties of opposite character to that of the white surfaces.

Opening and closing of the shutters will be initiated at temperatures of about 10° C. and 30° C. respectively. The size of the shutters will depend upon more detailed study of the internal power dissipation, but has been shown as being nominally 24 in. × 6 in., three on each face of the canister. It is proposed to mount all the electronic equipment on a heat conducting frame.

Communications Link

In designing the satellite transceiver, Hawker Siddeley point out that the range of frequencies available, for reliable day-to-day communications between Earth and a satellite, is restricted by inospheric effects at the low frequency end and by atmospheric effects at the high frequency end. These effects basically limit the usable range to 300 Mc/s-10,000 Mc/s. On consideration of the aerial system required on the ground both for receiving and transmitting, it is desirable that the receiving aerial size should be as large as possible. This follows from the requirement that the satellite beam should just cover the visible part of the Earth's surface; the receiver power is then proportional to the area of the receiving aerial.

An aerial 100 ft. in diameter, which is probably the largest that can be produced commercially, would only be suitable for frequencies of 2,000 Mc/s or less, and hence this restricts further the upper limit of the satellite-to-ground frequency range to about 2,000 Mc/s. The frequency of the ground-to-satellite link, however, where a high gain is desirable, is not restricted in this way, and a 30-ft. aerial operating at 10,000 Mc/s would be preferable to that recommended for the satellite ground link.

The basic usable range quoted above can be further restricted on consideration of noise. At 300 Mc/s, galactic noise is large compared with receiver noise, but decreases as the frequency increases with an optimum for a conventional receiver around 1,000 Mc/s. By making use of parametric amplifiers or Masers, however, the optimum is determined by atmospheric absorption noise and the frequency can be raised to about 2,000-3,000 Mc/s.

With these frequencies in mind, the efficiency of the satellite transmitter is at its best when using travelling wave tubes. The currently available alternatives, transistors or disc seal triodes, are either not feasible or have low gain and efficiency at these frequencies. The efficiency of travelling wave tubes at saturation is about 15% and independent of frequency. Although below saturation this efficiency may be only 5%, the gain is usually at least 30 dB.

In the light of the above considerations, it is proposed that the satellite-to-ground link should operate at a nominal frequency of 2,000 Mc/s, while the ground-to-satellite link (because efficiency and noise are not so important) should operate at a nominal 6,000 Mc/s. These are frequencies that are already in use for microwave links on the ground.

Transceiver Equipment

There are three basic types of repeater for microwave links, but one which it is considered most suitable, for this purpose, is a non-modulating I.F. repeater. Here the incoming radio frequency is converted in the first mixer to about 70 Mc/s where most of the required gain is obtained and then reconverted to a radio frequency different from the input frequency (to prevent feedback) in a high-level mixer. A further stage of amplification by a travelling wave tube is necessary. The advantage of this scheme is that the I.F. amplifier can be completely transistorized.

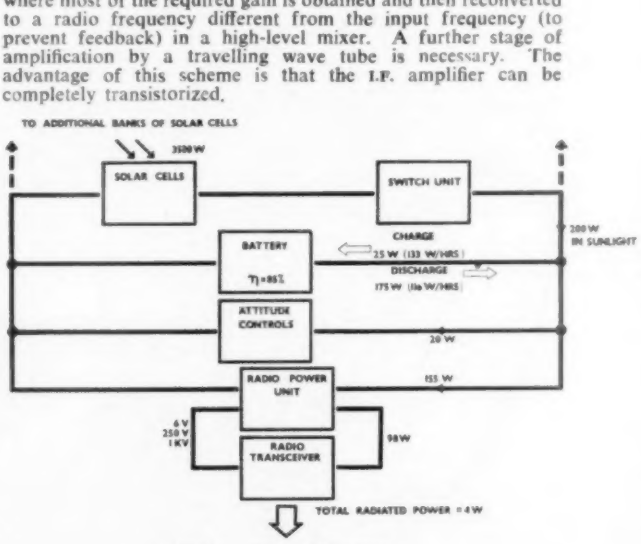


Fig. 4.—Power allocation.

Normally, it is necessary for a single two-way link to require four frequencies. In practice it should be possible for several pairs of ground stations to use the satellite simultaneously, and this can be achieved by dividing the transceiver equipment into a number of parallel units each handling the signals from one ground station.

In the present design, four such units have been planned and can be used by two pairs of ground stations simultaneously or by one pair with twice the number of channels. This system will require four frequencies in the 6,000 Mc/s band for ground-to-satellite links and four in the 2,000 Mc/s band for the satellite-to-ground links. The total radiated power from the transceiver is about four watts. The power requirements for the transceiver equipment, consisting of klystrons, shift oscillators, travelling wave tubes, and I.F. amplifiers, has been estimated at about 98 W.

Fig. 4 is a power allocation diagram for the satellite starting with the estimated power availability from the solar cells of 200 W. The power available to the radio equipment at 24 volts will be 155 W.

HAWKER SIDDELEY COMMUNICATION SATELLITE

Weight Summary:

Structure of canister	60 lb.
Solar cell array with supporting structure	200 lb.
Wiring and control gear	45 lb.
Attitude control system, including fuel and control electronics	100 lb.
Batteries	25 lb.
Aerials, receivers, transmitters and amplifying equipment	120 lb.
Total	550 lb.

Carrier Frequency:

Ground-to-satellite	6,000 Mc/s.
Satellite-to-ground	2,000 Mc/s.

Bandwidth:
Four bands each 2.6 Mc/s. wide.

Type of repeater:
Non-demodulating I.F. suitable for frequency-modulated signals.

Radiated power from satellite:
4 W. total.

Number of telephone channels:
100 two-way channels S/N ratio 40 dB.
32 two-way channels S/N ratio 50 dB.

Rocket Fuel at Half-price

HYDRAZINE, the liquid rocket fuel, can now be produced for less than half the present price. Aerojet-General Corporation, of California, has reported to the American Rocket Society that a nuclear reactor can produce hydrazine from ammonia at about 25 cents (under two shillings) per pound. This process is being developed for the U.S. Air Force.

Uranium 235, suspended in ammonia, is used for the hydrazine production reactor. Fission fragments of uranium break up ammonia molecules, some of which recombine to form stable hydrazine.

Circulation is continuous with the stream becoming sub-critical as it leaves the reactor. A yield of one molecule of hydrazine per 100 electron volts will produce an economical plant.

Experiments have exceeded this yield. Ammonia, hydrazine and uranium are drawn out of the reactor stream. A cyclone separator removes the Uranium 235 and feeds it back into the reactor. Hydrazine and ammonia are drawn off for additional processing and then separated. Fission fragments are removed and the ammonia is fed back into the reactor. The hydrazine is further decontaminated and stored.

A Rigid Balloon-satellite

A CONTRACT has now been placed by NASA for a second balloon-satellite to be used as a passive reflector for experiments in radio communications. It is to be made by the G. T. Schjeldahl Company, manufacturers of the original balloon-satellite Echo I.

The new inflatable sphere will be fabricated of laminated aluminium foil .0002 in. thick on each side of a layer of Mylar plastic .00035 in. thick. It will have a diameter of 135 ft. and weigh approximately 500 lb.; the 100-ft. diameter satellite Echo I weighed 136 lb. The new satellite is expected to remain spherical without internal pressure.

To keep the thermal balance of the satellite within bounds and maintain optimum electronic operating conditions, the satellite's skin will have a thin uniform coating of black paint on the inside and a dotted coating of white on the outside. The white surface will reflect excessive heat, while the black inner surface will distribute heat to maintain uniformity of temperature throughout the satellite's interior.

Sub-orbital tests of the ejection and inflation mechanism of the rigid spheres will be made from Cape Canaveral using a Thor rocket. It is planned to launch the first "rigidized" Echo communication satellite into a 700-mile orbit from the Pacific Missile Range next year using Thor-Agena B.

Solar Observatories in Space

IN addition to more conventional methods of studying the eclipse of the Sun on Feb. 15, Soviet scientists obtained photographs and spectrograms of the solar corona by means of high-altitude rockets. The sensing instruments were carried in jettisonable containers which were separated at the zenith of the trajectory, and "held steady in space by ground-operated control systems and later recovered by parachute." In addition to photographs and spectrograms recovered in this way, a large amount of information concerning solar radiation was telemetered from the containers to ground stations.

The corona was examined for the distribution and intensity of radiation from the X-ray, ultra-violet, visible and infra-red regions of the spectrum, and for polarization, etc. Meteorological rockets sent up before and after the eclipse measured changes in the condition of the stratosphere and the influence of solar emissions on the upper atmosphere during this period.

The use of a space-stabilized container—coupled with the increasing use of large orientatable satellites—suggests that it may not be long before the Russians put a stabilized astronomical observatory into orbit. The Americans have already embarked on their Orbiting Astronomical Observatory, which will have provision for precise pointing control. It will be capable of mounting a telescope mirror up to 36-in. diameter.

Experiments scheduled for this vehicle include an ultra-violet sky-mapping survey, multi-colour ultra-violet photometry of stars, low dispersion stellar ultra-violet spectroscopic studies, and absolute ultra-violet spectrophotometry of both stars and extended emission regions. Finally, a very high resolution ultra-violet spectrometer will be incorporated to examine in detail the absorption effects of the interstellar medium.

The satellite is expected to weigh about 3,500 lb. and to be placed by an Atlas-Agena B rocket in a near-circular orbit at 550 miles.

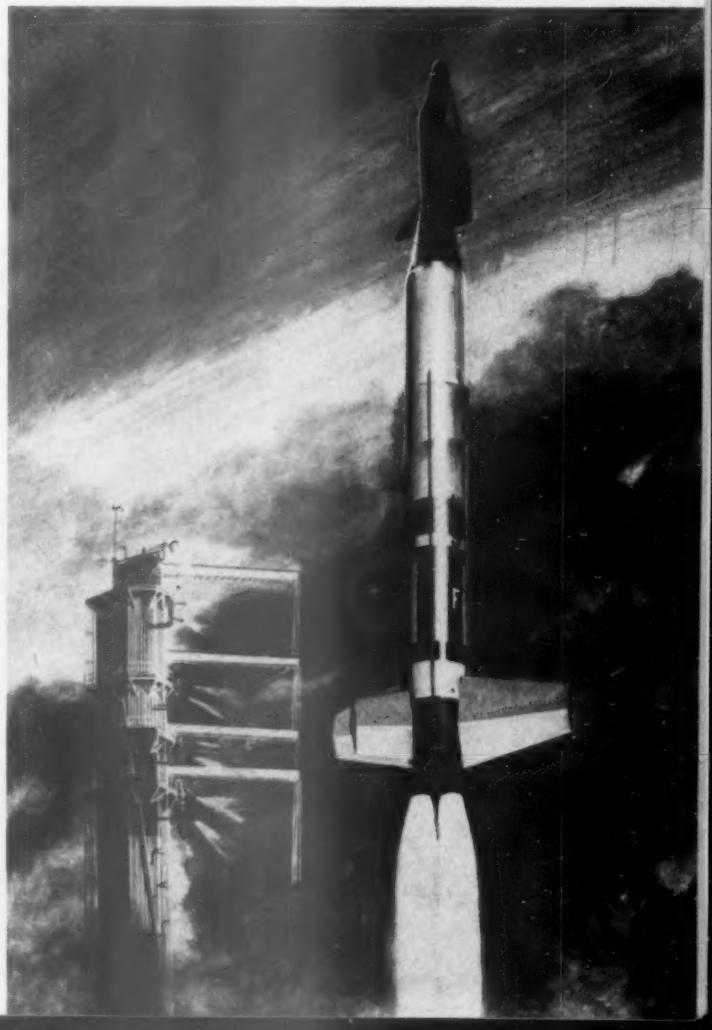
Of further interest is that, as originally reported in our issue of Aug. 2, 1960, Britain has an interest in a space-stabilized satellite with the primary object of carrying an ultra-violet telescope and spectrograph for studying ultra-violet radiation from the stars. It became known during the S.B.A.C. Show last year that Elliott Brothers (London), Ltd., were working with the R.A.E. on the stabilized platform for this project, and more recently the name of Grubb Parsons has been linked with the scheme as the designers of a 20-in. telescope mirror.

This project was originally considered as part of the Ministry of Supply-sponsored R.A.E. design studies for a satellite launcher based on Blue Streak and Black Knight in 1959, within a payload range of 1,000 to 1,800 lb. It would now presumably form one of the first scientific payloads for the projected European heavy satellite launcher.

Astronauts' "Space Kit"

ALTHOUGH one is used to ingenuity in the field of astronautics, a device recently proposed by engineers of the General Electric Company of Schenectady would take some beating. This is described as a "save yourself kit for space" and includes a retro-rocket for getting out of orbit and a "do-it-yourself" plastic heat-shield.

In the event of an emergency, the astronaut would "bale-out" of his space-station wearing a protective suit whereupon he would proceed to manufacture his own nose-cone for a rapid return to Earth. G.E.C. have already demonstrated foam plastic models which, they say, have been tested under simulated space conditions to prove that the idea works. In operation, plastic foam would fill an envelope which is pre-formed to the shape of a re-entry vehicle, at the same time encasing the man. The resulting vehicle "will protect the occupant from the severe heat and shock of re-entry and landing on Earth."



DYNA-SOAR BOOST.—This artist's impression shows the latest configuration of the forthcoming Dyna-Soar boost-glider as it will appear attached to the Martin Titan II booster. Scheme to use Titan I for sub-orbital tests has been abandoned.

Elliott-Automation and Aviation

The impressive new home of Elliott-Automation at Boreham Wood was completed at the end of 1959 and houses many of the company's research laboratories and development departments.

EVEN though it has become axiomatic that the products of the electronics industry now play an all-embracing part in aviation, it is none the less true that the extent to which this has become established is not always as widely appreciated as one would expect. This may in part be due to the fact that the electronics technologies are, generally speaking, highly specialized in their own right and their application to aeronautics has come about more by a process of infiltration than by one of deliberate adoption. Certainly the specializations peculiar to this particular industry have engendered a "black box" mentality among aeronautical engineers generally, who have in the past tended to regard electronics as a sort of technological magic potion instead of, rather more fairly, as a panacea.

However, be that as it may, during the past five years or so electronics in all manner of forms have become an integral part of the control and navigation systems for aircraft and missiles and have come to be accepted as a most valuable means of solving some hitherto insoluble problems. And as a result there has come into being a large section of the industry to specialize in aviation electronics as opposed to the more commercial varieties.

One of the larger companies in this particular field is Elliott Brothers (London), Ltd., a member of the extensive Elliott-Automation Group. During the post-War years the aviation interests of this company have grown from a comparatively small beginning into a comprehensive organization which embraces practically every form of electronic equipment used in aviation.

In point of fact, this degree of coverage has been a major underlying philosophy in the recent development of the Elliott aviation activities. Indeed, soon after the War, with remarkable foresight the company's managing director, Mr. Leon Bagrit, decided that complete automation in the control and navigation of aircraft—from start of take-off to end of landing—would eventually come to be both practicable and acceptable. From this it was but a short step to assume that this ultimate acceptance would demand a whole range of different types of equipment both for airborne and ground installations. And in planning the step-by-step development and growth of this part of his company, this was what he aimed at.

Fulfilment of the complete aeronautical automation that was then envisaged is still some years away, but the Elliott aviation divisions have already achieved a finger in nearly all the electronics pies that may be involved. Indeed, it is only a matter of time and a proper continuity of research and development before this effort can be expanded to achieve the final goal.

After all, this is a logical enough development because the general concept of automation—or, more correctly, control and systems engineering—as applied to aviation is basically similar to that employed for the wide variety of industrial applications which form the bulk of the Elliott Group's extensive business. There are in fact inevitable links because the development effort which goes into much of this industrial equipment can frequently have a direct influence in the complementary development of an aeronautical application and vice versa.

As a case in point, it is no great step from the work done in producing computers for industrial use to the development of computers for application to air traffic control problems. Looking even farther ahead it would be surprising if all this experience has not led to an appreciation of the essential requirements for a light and compact computer for installation in an aircraft. This will certainly be needed for dealing with the complex navigation and control problems that will be posed by the coming generation of supersonic military—and civil—aircraft for which the pilot will be little more than a monitor for electronic equipment which does all the work and most of the thinking.

This is but one example of a development sequence that

(*Continued on page 263*)

At Rochester, a large part of the company's aviation activities is centred. This is the new electronics assembly section for autopilots and other aeronautical equipment.

Photograph copyright "The Aeroplane and Astronautics"

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Squadrons of today's Royal Air Force, No. 4 of a Series

Base: Gibraltar

Rôle: Maritime reconnaissance

Even before there was a Royal Air Force, No. 224 Squadron—or its ancestor No. 24 R.N.A.S. Squadron—was hunting submarines. This is one of the most taxing and most complex jobs in the Service, and the members of the Squadron bring a wealth of experience to the work they do: patrols from the South of Italy in World War I to the North of Norway in World War II; the battle of the Atlantic; close-support in the Channel on D-Day—one aircraft alone killing, in one night, 2 submarines in 22 minutes; the list seems endless. The long hours of patrolling over the sea do not, perhaps, provide the most dramatic example of the use of air-power. But in strategic importance, and in the demands it makes, in skill and endurance, on the men who do it—anti-submarine work is second to none.

Today, No. 224 Squadron is still on anti-submarine duties—stationed, now, at Gibraltar. The sun and sea, the wine and food, all the things that make a once-a-year civilian holiday, are there on the doorstep. The Costa del Sol, with resorts like Torremolinos, is within picnic range. And if the wives want a change from British goods at foreign prices in Gibraltar's excellent shopping centre, they can stroll across to Spain!

THE C.O., WING COMMANDER J. G. DUNCAN, M.B.E., M.A. *(Eng. Lit. and Philosophy) is 37 and joined the R.A.F. through the Glasgow University Air Squadron. With 6 aircraft and 130 people in his charge, he has plenty of desk-work to do, but still looks on himself as aircrew and does a full quota of flying. As C.O., he has his own house on the Station where he lives with his wife and two young sons.*

N.C.O. AIRCREW. SGT. J. S. DOONAN *(26, married, one daughter) is one of the four air signallers in a Shackleton crew. Has played rugger (scrum-half) for Coastal Command. Just accepted for navigator training, he plans to take a 16-year commission. Like most of the Squadron's N.C.O's, he runs a car: his is a 1957 Hillman Minx.*

SQUADRON LEADER P. J. WELLS, 35, *flew with the British airlift into Agadir after the earthquake. He is a navigator and aircraft captain and also commands the Squadron's ground crew. He is now on his second overseas tour and enjoying every minute of it. His wife, daughter and two sons live in Gibraltar with him—and love it.*

FLIGHT LIEUTENANT STANLEY CROCKFORD is 27, *comes from Doncaster and went to a Grammar School. Captained his first aircraft at 20. Lives with his wife Jean and daughter Ann (a fetching 2½, who speaks fluent Spanish to the Crockfords' maid) in an excellent furnished flat in the new Officers' Married Quarters. They plan a 2-month caravan journey back to the UK when his Gibraltar tour is over.*

FLYING OFFICER M. REVELL, 27, *comes from Chester-le-Street where he went to a Grammar School. After 5 years as a Sgt. Signaller, he was commissioned in December 1959 as an Air Electronics Officer. His task is one that fascinates him—radio and radio-control are his pet hobbies. But he still finds time to be a keen all-round sportsman and Treasurer of the Station Sub-Aqua Club.*

FLYING OFFICER J. R. MAUNSELL-THOMAS, 23, *passed out of Cranwell in July 1958. Before that he had held a Flying Scholarship. His first posting was to Bomber Command, flying Valiants. Then came the 5-month-long conversion-course to Shackletons which he now flies as co-pilot. A keen skier, he is about to start a water-ski club. His home town is Maidenhead.*

The R.A.F. needs more men like these

Operationally, No. 224 Squadron is part both of Coastal Command and of NATO. In its anti-submarine role, it exercises regularly with the Royal Navy and other NATO forces. These exercises are tough—a sortie can last 15 hours or more, and altitude is seldom much above 1,000 feet. The Shackleton, unspectacular though it may appear, is in fact the best aircraft in the world for this work, and crammed with the most advanced 'black boxes'. It can see, hear, and literally smell a submarine from many miles away.

The captain of a Shackleton has to be a fighting leader with highly developed tactical instincts. On patrol he is 'out on his own', without direction from the ground, and in command of nine other men—the largest crew in the Service. They fly, of course, as a team; but the captain's tactical decisions are probably the most important, as well as the most complex, that any aircraft captain is ever called upon to take. It is he who must anticipate, outwit, and ultimately kill the submarine.

And this the captains and crews of No. 224 Squadron know very well how to do: they are among the most accomplished hunter-killers in the Service. The Squadron has won trophy after trophy for efficiency and skill.

Anti-submarine work is the Squadron's primary role, but by no means all it does. It also trains for medium-level bombing, does photography, and has Search and Rescue responsibilities over a wide area of the Atlantic. As recently as last August it located a Lebanese ship which had been cut in half by a tanker in fog. In its transport role the Squadron provided almost the whole of the British airlift in relief of the Agadir earthquake; flying in supplies and medical teams, flying out women and children.

Anti-submarine, plus bombing, plus photography, plus transport . . . add to all this detachments in Ceylon, a goodwill tour of South America, special flights all over Europe—compare it with the sort of work that you are doing now . . . and you will begin to see some of the variety, interest and satisfaction which a flying career in the R.A.F. would hold for you.

TODAY'S TOP JOB IS THE R.A.F.

The Royal Air Force

With a flying commission you are guaranteed service to at least 38 (or for 16 years, if this is longer), and this may be extended to the age of 55. You can also choose to leave after 8 or 12 years' service. There are a few commissions which allow you to leave after 5 or 8 years' service. These periods of service carry tax-free gratuities: 5 years—£775, 8 years—£1500, 12 years—£4000.

If you serve to age 38 (or for 16 years), or longer, you receive a life pension of at least £455 a year in addition to a tax-free gratuity of at least £1365. Pay is excellent: at 21, as a Flying Officer you would earn £950 a year; at 25, as a Flight Lieutenant on full allowances, you could be earning over £1,750 a year.

To be eligible you should have, or expect to gain, G.C.E. (or equivalent) with five 'O' levels in acceptable subjects.

If you are under 26, find out more about flying careers by writing, giving your date of birth and educational qualifications, to: Group Captain J. N. Ogle, A.F.C., A.F.M., Air Ministry (AP155), Adastral House, London, W.C.1.

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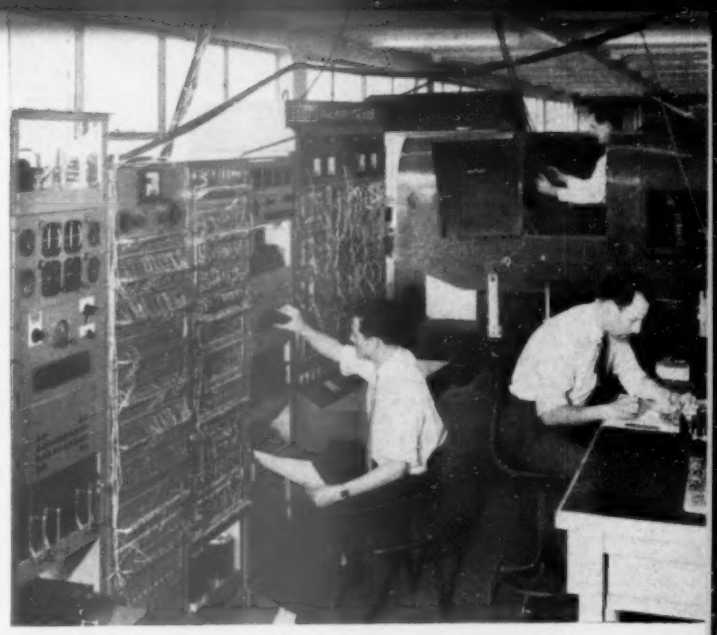


Part of the civil aircraft controls division in which the flight control system for the Vickers VC10 is being developed.

(*Continued from page 262*)

can easily start industrially at sea level and finish supersonically on the fringes of space. And equally there is a reverse trend in which equipment intended initially for aviation finds its way by a similar evolutionary process into a factory or some other commercial undertaking.

Quite clearly, an ambitious programme of the sort envisaged by the Elliott team could not be accomplished without an extremely heavy development and research expenditure in terms of cost and time. It would, indeed, normally be beyond the capacity of any one organization or even a normal group of organizations.

This, then, has dictated another basic Elliott philosophy. If any particular type of equipment is needed, either for a specific purpose or to close one of the many gaps in the progress towards the complete production coverage decided upon, it is the company's policy to do the necessary research and development only if no suitable equipment is available from an outside source. If such equipment does exist, whenever it is feasible a licence agreement will be negotiated. To date, there are about 50 aviation products covered by such agreements and the saving in development time and cost that this represents can be reckoned to run into hundreds of thousands of man-hours and millions of pounds.

At the present time the aviation divisions of Elliott Brothers (London), Ltd., employ something like 3,000 people mainly in the factories at Boreham Wood and Rochester. They are divided among two major sections within the company—a Guided Flight Group and a Radar and Communications Group. The former controls sub-sections, or "divisions," dealing with military aircraft controls; civil aircraft controls; aero-engine instruments; aircraft equipment service and repair; inertial navigation equipment; gyroscopes; and automatic test equipment. The Radar and Communications Group has divisions covering airborne radio and radar; ground radar; telecommunications; microwave and electronic instruments; microwave valves; weapons guidance systems; and radar research.

Also contributing to these aviation interests are the company's servo-components division; the relay division of an associated company, Associated Automation, Ltd.; and another associated company, Black Automatic Controls, Ltd.

The original William Elliott started an instrument business in Sash Court, Greys Inn, in 1800 and later took his brothers into partnership. The firm of Elliott Brothers (London), Ltd., then occupied several different premises in London before it moved to Lewisham in 1899, to occupy the new Century Works. The company specialized in scientific instrument design and development and quickly established an enviable reputation. Its records show that among its early specialities, which included periscopes, microscopes and barometers, were precision measuring and calculating devices for such of the scientific "giants" of the day as Faraday, Rayleigh and Babbage.

The company has in fact retained a close association with this sort of work; but more recently it has expanded with the times into many other scientific activities concerned with measurement and control equipment for a wide range of industries. And this has led it to a place of importance in the field of automation.

Elliott's association with aviation seems to have started in 1909 when the company produced a rev.-counter for aircraft use. In 1912 the company was supplying aircraft instrument panels complete with A.S.I., climb and descent indicator, altimeter, rev.-counter and clock. These interests led to a large production output of aircraft instruments during the First World War.

After the Armistice these aviation activities were dropped and the company did not really come back to the aeronautical scene until World War II when it again produced many types of aircraft instruments and special equipment. This production, carried on at the Lewisham works, suffered the inevitable cut-back after the War and the team concentrated on expanding its other production and research and development resources, particularly in the comparatively new electronics field.

To this end in 1946 it leased from the Admiralty some premises at Boreham Wood, near Elstree, in Hertfordshire, which had been a fuse factory during the War. This added a welcome 60,000 sq. ft. to the company's available floorspace and formed the nucleus of the remarkable expansion which has been so characteristic of the company's post-War progress.

Elliott's re-entry into the world of aviation came in about 1950 when the company received a contract from the, then, Ministry of Supply for an electronic autopilot system for target aircraft. This was at a time when the guided missile business was beginning to make itself felt and it became clear that representative targets would be needed for the new air-to-air and surface-to-air weapons scheduled for testing at the Ministry's guided missile range at Aberporth in Cardigan Bay.

Among aircraft concerned were Meteor Mk. 4s converted to drones by Flight Refuelling, Ltd.; and the Elliott team was given the task of developing and producing for them an R.A.E.-devised autopilot known as the Type B. This work was undertaken at the company's Rochester establishment which it had set up in 1947 to provide the further floorspace demanded by its rapidly growing business. (The Rochester section was, in fact, a 200,000-sq.-ft. portion of the old Short Brothers factory at the airport which had become vacant when Shorts moved to Belfast; nearly half of it was immediately employed on aviation work.)

By the end of 1952 the work on autopilots was firmly established at Rochester and had been extended to cover yaw stabilizers for high-speed military aircraft and the licensed manufacture of American Bendix gyroscopes and accelerometers and associated equipment. This—coupled with the much wider resources the company had by that time developed, particularly in the electronics field—led to the establishment of a separate Aviation Division with a view to further expansion of the aeronautical side of the company's business.

Within a comparatively short time, the Aviation Division at Rochester had grown to employ some 650 people and its first autopilot and integrated flight instrument system for supersonic aircraft was already in an advanced stage of development. Advanced work was being done on navigation systems and a range of engine instruments was being produced. The Division had, in fact, become a comprehensive unit with a wide range of specialized environmental test equipment. And not unnaturally in a company closely associated with electronic developments, both analogue and digital computers were available for advanced work on autopilot and flight instrument systems.

During the past five years, there has been considerable further expansion of the company's premises and activities and the original Aviation Division has been broken down into the two main groups and their sub-sections. At Rochester, for example, the available floor area is now of the order of 400,000 sq. ft. and a large part of this growth from the original 200,000 sq. ft. has been made necessary by increases in the aviation side of the business. At present some 1,750 people are employed there on aviation equipment of one sort or another.

The latest planned development at Rochester is a very fine new building which will add another 450,000 sq. ft. to the total. This extension is being built in stages, the first of which is expected to be ready for occupation by the end of April this year. When completed the building will in fact be the focal point of all the company's aviation interests.

At Boreham Wood, the original premises have now taken second place to a spacious and attractive new main building housing many of the company's expanded research laboratories and development departments. This building, which has added another 100,000 sq. ft. of floor space to the company's Elstree establishment, was completely occupied by the end of 1959.

As has already been indicated, the products of the two groups within Elliott Brothers (London), Ltd., most concerned with aviation matters, are many and varied. It is not possible in a general survey of this nature to deal with these in any detail but for completion of the picture it is necessary at least to summarize the most important of these products.

For example, from the Radar and Communications Group comes a whole range of airborne VHF communications and navigation equipment intended primarily for airline use. This is

the Elliott 21 Series, built under licence from the Bendix Corporation, and offers multi-channel communications facilities, VOR, ILS, glide slope and marker beacon reception. Two of the principal features of this equipment are its small size and low weight—the complete installation weighs about 50 lb. and occupies a volume of less than 0.5 cu. ft. This has been made possible by the extensive use of transistors and miniaturized components.

It might be noted here that, to date, initial orders for £500,000-worth of Elliott 21 Series equipment have been placed with the company for Transport Command's Comets, Argosies and Belfasts.

Airborne weather radar equipment is also in production and again is based on the Bendix range. This equipment has a sight range of around 150 miles and it can also be used as a navigation aid in ground mapping and drift measurement.

Following development by the Royal Aircraft Establishment of an automatic blind landing equipment at Bedford it was appreciated that the leader-cable system employed raised some practical installational difficulties when it came to application of the system at some other aerodromes. As one way of obviating this, the R.A.E. proposed the adoption of microwave beacons to replace the cables and because of Elliott's extensive experience in microwave techniques in relation to radar data link and ground communications equipment generally, they were given the task of studying this proposal for the Blind Landing Experimental Unit.

This beacon system comprises two small transmitters and aerials placed each side of the runway near the touch-down point and giving an azimuth guidance path similar to that from the earlier leader-cable system. Experimental equipment is now in an early stage of evaluation at Bedford.

Among items of ground communications equipment of interest is the company's simple four-channel UHF transmitter/receiver intended for small airfields that do not need the larger, and more expensive, equipment. And for transmitting radar data from a remote site to a main air traffic control centre, a 7,500-megacycle multi-channel transmitter is available.

A comparatively new piece of airborne equipment produced by Elliott's is a 16-channel universal fully transistorized tape recorder with five tape speeds from 1¼ to 30 in. per sec. This recorder weighs only 90 lb. and can use ¼-in., ½-in. or 1-in tape. It is intended primarily for the recording of instrumentation data in guided weapons or aircraft.

In the guided weapon field the company has developed a search and monopulse auto-follow radar for tracking short-range missiles. This equipment, which is Elliott's own development, operates on an 8-mm. wavelength and is small and compact enough to be mounted on the back of a jeep. Because of its high order of accuracy, another possible application of this interesting search-and-follow equipment is in providing range and track information from which command signals can be computed on the ground for transmission to the autopilot of an aircraft for automatic landing.

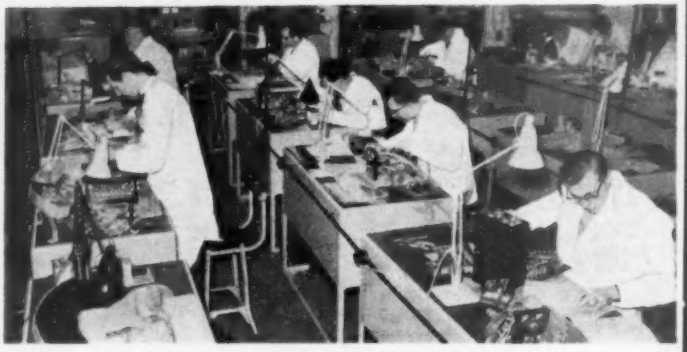
Weapon guidance systems are well represented in the Elliott range of equipment by the homing heads developed for use with the R.A.E./Short general-purpose experimental test vehicle. These heads, one version of which is stabilized by line-of-sight gyros and another by rate-gyros, are of the semi-active homing type and have been produced under a Ministry research and development contract for the investigation of the problems of homing guidance.

A particularly important effort on the part of the Elliott team is related to the production of a multi-channel air-to-ground telemetry system. This is, in fact, being done by a consortium of five electronics concerns—of which Elliott is one—in collaboration with the R.A.E., which developed the initial system. The equipment has a "line of sight" of more than 100 miles and in its simplest arrangement can offer eight possible instrumentation channels accepting signal frequencies up to 700 c/s. By the use of time multiplexing, six channels are retained independently and the frequency band of the other two channels is used to extend the system to cover no less than 29 parameters.

As the name implies, the activities of the Guided Flight Group are largely concerned with control systems for aircraft and missiles. Among these has been the development of an inertial navigation system for the Avro Blue Steel stand-off bomb; no details of the equipment have been disclosed, but it is known to be in quantity production.

Detailed information about the Group's autopilot and associated control systems for military aircraft is likewise also restricted. Among current high-speed target aircraft, the Australian Jindivik drone is equipped with an Elliott autopilot system with which it can be readily controlled from take-off to touch-down through speeds up to 600 m.p.h. and at heights of more than 40,000 ft. Total installed weight is about 62 lb.

For the later versions of the Meteor target aircraft a Mk. 16 autopilot system is in production. This enables the aircraft to be flown from a ground station or, when required, by pilot supervision; it gives full control at speeds of Mach 0.73 and at altitudes up to 50,000 ft.



Assembly, at Rochester, of junction boxes for the Meteor drone autopilot unit.

A fully automatic integrated flight control system for supersonic aircraft developed by the Elliott team has been adopted for the English Electric Lightning. And the company has also developed the control system for the Blackburn Buccaneer, which can be flown completely automatically to a predetermined programme for its special rôle as a low-level strike aircraft.

On the civil side the principal effort at the moment is devoted to the development of the complete duplicated autopilot control system for the new Vickers VC10 civil turbojet transport. This system is based on the use of standard Bendix PB 20 components and will provide for automatic landing control.

Two separate systems are, in fact, to be installed—each of which is self-monitoring. Only one system is normally in use, but any failure is automatically detected and the standby system immediately switched on.

Each system incorporates the basic facilities of ILS coupling; fully automatic throttle control; VOR coupling; heading control; height, airspeed and Mach number links; dual yaw dampers; and dual automatic trim. For the VC10, too, Elliotts are providing the Bendix 100 series integrated instrument and flight director system, and the Polar Path compass system, all of which they make under licence.

An important product of the engine instruments division is a true-mass fuel-flow metering system for application to long-distance high-performance turbojet or propjet aircraft. For these the measurement of fuel consumption in flight is of paramount importance and for the next generation of such aircraft—particularly the supersonic turbojet transports—fuel-flow measuring equipment as an integral part of an overall fuel management system is likely to be a prime requirement.

The Elliott equipment in this field employs a true-mass flow-meter coupled to an electronic computing circuit which measures and indicates the rate of mass flow and the fuel consumed. The accuracy attained by this equipment will clearly depend on the fuel concerned and on the environmental conditions; but ±2% is reckoned to be its maximum error over the principal part of the flow-rate range under extreme conditions of temperature and fuel. Overall system accuracy under normal operating conditions is better than ±1%.

For this system, which is based on Bendix-designed equipment, the principal unit is a transmitter that accepts fuel which has been given truly axial flow and imparts to it an angular acceleration by means of an impeller driven at a constant speed. The torque required to accelerate the flow to a given angular velocity is a function of the true mass-flow through the unit which can, therefore, be measured and indicated.

It has been claimed that the Elliott-Automation Group is the largest in the World wholly devoted to system and control engineering and the development of the techniques of automation, and that it is the principal European manufacturer and exporter of computers. As a part of this electronics complex Elliott Brothers (London), Ltd., is in a strong position to play a leading part in the application of these techniques to aviation.

Aeronautical automation embraces autopilot flight control, en route navigation and air traffic control; it demands data transmission within the aircraft, telemetry of position and performance information from the aircraft to the ground, and the relay of data from radar tracking equipment to control centres; and it depends to a large extent on airborne and ground-based computing equipment. From the foregoing brief survey it will be clear that Elliotts are well equipped and well constituted not only to cater for all these requirements but to consider the entire range of equipment needed.

Aviation News in General

TRACTOR-PUSHER.—First photograph of the new Cessna light twin, the Model 336 or Skymaster, which made its initial flight last week at Wichita. The twin-boom four-seat Skymaster uses many existing Cessna components.

EXPORTS.—Exports by the British aircraft industry during January were worth £12.85 million; this was £1 million more than the monthly average during 1960. The January exports included a record £7.5 million for aero-engines.

MILITARY HOVERCRAFT.—Naval rôles for hovercraft were predicted in Parliament on Mar. 3 by Mr. Charles Orr-Ewing, Civil Lord of the Admiralty. All three Services are interested in hovercraft and the Admiralty is co-ordinating its initial development for military use. Hover height must first be increased to allow operation in more varied sea conditions. Hovercraft might be used for amphibious warfare, ferrying, air-sea rescue, mine hunting and anti-submarine warfare.

INDIAN CARRIER.—I.N.S. "Vikrant," the first aircraft carrier for the Indian Navy, was commissioned last week by Mrs. Pandit, the Indian High Commissioner. Originally launched, but never completed, as H.M.S. "Hercules" in 1945, she has been fitted out and modernized in Belfast.

TURBOMECA MARQUIS.—Production examples of the Turbo-Travelair, modified from Beech airframes by the Turbomeca company, will now be known as Marquis. The installation of twin Astazou turboprop units has more than doubled the power of this four/five-seat executive aircraft.

S.A.C. TRAINING.—Mobile radar bomb scoring (R.B.S.) equipment mounted on 10-coach railway trains have been introduced for use in S.A.C. "Oil Burner" training missions over the United States. Supplementing the existing fixed R.B.S. sites which have been in operation with "Oil Burner" low-level B-47, B-52 and B-58 exercises since November, 1959, the R.B.S. trains will be moved to new locations every 45 days to simulate different target areas.

EUROPEAN F-105s.—First U.S.A.F. unit in Europe to be equipped with Republic F-105D fighter bombers will be the 36th Tactical Fighter Wing based at Bitburg in Germany. Their conversion from F-100s to F-105s will begin this spring.

CHINOOK ORDER. — Eighteen Boeing Vertol HC-1B Chinook helicopters have been ordered for the U.S. Army. The order is worth $25 million. It follows an earlier order for 10 development Chinooks, five YHC-1B and five HC-1B.

AIRTECH AND THE ARGOSY.—An error appeared in the Airtech, Ltd., advertisement on page 22 of our Mar. 3 issue. In the third paragraph the word "listing" should, of course, have been "lifting."

BLUE STREAK COST.—"The cost of maintaining Blue Streak teams in being, which is of course essential if we are to go forward at all, is somewhere about £300,000 a month." This was stated in Parliament on Feb. 27 by the Minister of Aviation.

SPUTNIKS DOWN.—The French Meudon Observatory states that both Russian satellites launched on Feb. 4 and 12 have re-entered the Earth's atmosphere and burned up. Sputnik VII—stated to have weighed 6½ tons—was last observed on the night of Feb. 29. Sputnik VIII, which launched the Venus probe from orbit, apparently burned up the night before. NASA had previously reported that the latter was orbiting in two parts.

COSPAR SYMPOSIUM.—A second "Space Science Symposium" is being arranged in conjunction with the fourth meeting of the Committee on Space Research (COSPAR) to be held in Florence from Apr. 7-18. Symposium will include papers from a wide range of countries, including Russia, giving latest results obtained with sounding rockets, artificial satellites and space probes. Business sessions, Apr. 7, 8, 15-18; Symposium, Apr. 10-14.

JUNO FAILURE.—A Juno II rocket launched from Cape Canaveral on Feb. 24 failed to carry the 74-lb. ionosphere beacon satellite S-45 into orbit. An upper stage did not ignite.

ROCKET BASE BLAZE.—The joint Canadian/U.S. scientific rocket base at Fort Churchill on Hudson Bay, Canada, was severely damaged by fire on Feb. 28.

PHOTONDARD. — Etendard 07 is the first of this range of Dassault ship-board fighters to be developed for tactical reconnaissance. A new nose houses three cameras and flight-refuelling equipment, and two large cameras are stowed in the gun bay. The French Navy has ordered 15 of this Etendard IV-P version.

Commercial Aviation Affairs

TURBOFAN CERTIFICATE.—The F.A.A. has issued a certificate of airworthiness for the Boeing 707-120B, turbofan-engined variant of the original 707 model. The certificate permits operation at speeds up to Mach 0.9; the 320-hr. test programme since Jne. 22 last year included dives to Mach 0.95 and take-offs at 270,000 lb. American Airlines will introduce 707-120B services under the name Astrojet on Mar. 12.

LOS ANGELES SERVICE.—B.O.A.C. inaugurated its direct Boeing 707 service between London and Los Angeles on Mar. 2 (see our issue for Dec. 9, 1960). At an initial frequency of two a week, increasing to three after May 1, the service makes a technical stop at Montreal westbound and when necessary eastbound. Journey times are 14 hr. and 10 hr. 50 min. respectively.

AIR/SEA INTERCHANGE.—From Apr. 1, B.O.A.C. will offer air/sea interchange rebated travel facilities on a world-wide scale in conjunction with major steamship companies. Fare discount advantages will be available to travellers combining aid and sea passages.

CUNARD EAGLE BRITANNIAS.—Two of Canadian Pacific Air Lines' Britannias (324s) have been bought by Cunard Eagle Airways for delivery on Mar. 8 and May 1. They will (see "Cunard Eagle's Atlantic Aspirations," pp. 254-256) be used on the Bermuda-Nassau-Miami and Bermuda-New York services.

POLISH Il-18s.—Three Ilyushin Il-18s are to be delivered to the Polish airline LOT in the near future. Four turbojet transports of unspecified type are reported to be on order.

L.A.P. CAR PARKS.—A multi-storey garage is to be constructed in the Central Area of London Airport but will not be available before 1962. To discourage long-term parking in the existing parks this summer, the charges have been increased to £1 a day for periods of two to four days and £2 a day for more than four days. Increases ranging from 6d. to 3s. have been made in the charges for short-term parking.

S.A.S. GERMAN AGREEMENT.—A compromise agreement concluded between S.A.S. and Western Germany limits to 16 per week the number of landings made by S.A.S. aircraft in Germany on transit flights. In addition approximately 50 flights a week will be made by S.A.S. to and from seven German terminals.

CANADIAN RECRUITS.—B.E.A. has recently recruited 37 Canadian pilots who have been flying Viscounts with T.C.A. but became redundant upon introduction of the Vanguards, which are operated in Canada with only two pilots. B.E.A. Vanguards (and Comets) have a crew of three pilots. Ten more Canadian pilots have been recruited by B.E.A. from the R.C.A.F., and Aer Lingus has engaged 16 T.C.A. pilots.

PHONE FROM AIRCRAFT.—From the beginning of this month an aircraft-to-ground HF long-range radio-telephone service has been available in the U.K. The service is available to any aircraft, subject to satisfactory tests by the G.P.O., but only El Al is at present making use of it. Basic charges are £1 16s. for three minutes from an aircraft in the Northern area within the limits of 35° W, 35° E and 35° N, and £3 for three minutes outside this area.

C.A.A. PURCHASE.—A Viscount has been purchased by C.A.A. from M.E.A. to increase the former's fleet to five Viscounts, in addition to six DC-3s and six Beavers.

GOOD CAMBRIAN YEAR.—A net profit for 1960 of £50,000 (£40,000 in 1959) has been announced by Cambrian Airways. The number of passengers carried increased by 37% to 54,937—41,300 of them on the Channel Islands' services. The Bristol/Cardiff-Manchester services carried 7,854 passengers—a significant increase of 200% on the 1959 total. Three more DC-3s are being bought for 1961 operations, making a fleet total of eight.

AIR SCOOTER. — The DH-1A Courier version of the Del Mar Whirlymite helicopter is now in its final flight-test phase. It is powered by a 60 h.p. Kiekhaefer Mercury engine.

Howard Levy photograph

O.A.T. SCHEDULE.—Overseas Air Transport, the charter operator at Manchester Airport, has received permission to operate a scheduled service between Manchester and the Isle of Wight (Sandown). Herons will be used for the service, which will operate initially only at week-ends.

PAKISTAN AIRBUS.—A no-frills, no-reservations Airbus service will be started in East Pakistan on Mar. 25 by P.I.A. DC-3s will be used and the fares will be approximately 60% of those charged on standard services, or about equal to the second-class rail fare. Freight rates have also been reduced to encourage the use of air transportation in East Pakistan. The Airbus services are not expected to be profitable but are expected to promote airmindedness.

F.A.A. AIRCRAFT.—Five Convair 440s used by the F.A.A. for airways inspection are to be converted to Allison Super Convair standard with 501D-13 turboprops to permit increased annual utilization. They will be converted by Pacific Airmotive between now and October.

NEWS OF DULLES.—Delays in constructing the terminal building at Dulles International Airport, Washington, have postponed the expected opening date from July of this year until next spring. A contract was recently awarded for construction of a 200-room hotel to serve the airport.

A.R.T.C.C. IN PACIFIC. — The F.A.A. has opened a new air route traffic control centre and international flight service station at Honolulu. It connects eight major stations and a number of smaller ones in the Pacific area and services more than 50,000 miles of communications networks.

SCOTTISH AERODROMES.—Under a rearrangement in the M.o.A. Scottish Division, Stornoway, Benbecula, Machrihanish, Port Ellen (Islay) and Tiree now constitute the western group of aerodromes under Commandant John R. Giles; the northern group under Commandant G. T. Stanley comprises Inverness, Wick, Kirkwall and Sumburgh, and eastern group under Commandant J. C. Halley comprises Edinburgh and Aberdeen.

MINISTRY MOVE.—The Civil Aviation Divisions of the Ministry of Aviation have now moved from Berkeley Square House to Shell-Mex House, Strand, W.C.2, and the Adelphi, John Adam Street, W.C.2. The main inquiry room is at Shell-Mex House (Temple Bar 1207, ext. 188 or 686).

News About People

RECOGNITION. — The Segrave Trophy for 1960 has been awarded to Mr. Tom Brooke-Smith, until recently chief test pilot of Short Brothers, "for his outstanding flight test work during the development of the SC.1, culminating in its demonstration during 1960 of transition from vertical to horizontal flight." Earlier this year it was announced that Mr. Brooke-Smith had been awarded the Britannia Trophy.

NAPIER APPOINTMENT.—Mr. C. L. Cowdrey, F.R.Ae.S., M.S.A.E., has been appointed general manager (Luton) for D. Napier and Son, Ltd. He was formerly manager of the company's Luton establishment.

PAKISTAN APPOINTMENT.—Mr. Ronald Bradbury has been appointed sales superintendent of Pakistan International Airlines in the U.K. and will be responsible for the whole of the U.K. sales force. New offices have been obtained for the Sales Division at Airwork House (35 Piccadilly) and at 35 Sackville Street; the existing office at 45 Piccadilly will remain as a reservations and ticket office.

FAIRCHILD PRESIDENT. — Mr. Edward G. Uhl has been elected president of the Fairchild Engine and Airplane Corpn., in succession to Sherman Fairchild. He was previously vice-president and San Diego division manager of the Ryan Aeronautical Co.

Mr. Eric Greenwood, O.B.E., who started his test flying career with Sir W. G. Armstrong Whitworth Aircraft Ltd., Coventry, has rejoined the company as chief executive to the managing director. He will be based in London.

GAPAN LECTURE. — The chief engineer of Bristol Aircraft, Ltd., Dr. A. E. Russell, is to lecture to the Guild of Air Pilots and Air Navigators on "Supersonic Transport" on Mar. 28 at 18.45 hrs. Admission to the lecture, which will be held at the Institution of Mechanical Engineers, 1 Birdcage Walk, S.W.1, is by ticket only obtainable from 14 South Street, W.1.

SOLARTRON BOARD.—Three new appointments to the board of the Solartron Electronic Group, Ltd., are Mr. L. Malec as director of systems sales, Mr. H. D. Binyon, director of product sales and Mr. R. Catherall, director of research and development.

PUBLICITY CHIEF.—As group publicity director Mr. Graham Cooke is to look after the advertising and public relations interests of the Firth Cleveland Group. He remains a director of Solartron Electronics which is now part of the Firth Cleveland Group.

British Executive Operators

3 Woods of Colchester, Ltd.

Mr. Geoffrey Woods.

ALTHOUGH a few companies in Great Britain have used aircraft for a good many years to further their business interests, the advantages and, quite often, the indispensability of executive flying have still to be realized by the great majority of industrial organizations. There is less resistance to the idea of business aircraft than there is ignorance of their potentialities, and this need for air education among the higher ranks of executives will presumably be one of the first things to receive attention from the newly formed Business Aircraft Users' Association.

This series of articles is also designed to widen interest in executive flying by discussing both its virtues and its problems from the practical viewpoint of current operators. At the moment, nearly all those in the U.K. are in the formative stage, with only single aircraft, but it is quite clear from such examples as Woods of Colchester, Ltd., that the growth potential is very substantial, and that the surface of executive operations has barely been scratched.

Woods of Colchester are manufacturers of industrial fans; they are, they claim, the largest exporters of such equipment in the World. They took delivery of a new Aero Commander 500B, from Field Aircraft Services, the U.K. agents in December, 1960. Within two months of starting operations, the Commander had flown 140 hr. on company business throughout Europe, and in the 12 days between Feb. 20 and Mar. 4, its flight schedule was no less than 50 hr. It is planned to average 80 hr. per month throughout the year, which, with a single pilot, represents a truly formidable utilization and an excellent application to business use.

Although it is too soon for a detailed analysis of the Commander operations to be made, its intensive flying schedule has already vindicated the decision of Mr. Geoffrey Woods, chairman of the Colchester company, for its purchase. It was chosen as a larger successor to the company's first aeroplane, a four-seat Beech Travel Air bought new in mid-1959, which did nearly 800 hr. in a year's operating time. The Travel Air was put up for sale after the arrival of the Commander, but the Beech twin may now well be kept as part of the initial expansion of the Woods' fleet.

For the fullest appreciation of the company's operations, an outline of the activities of Woods of Colchester is necessary. From employing 120 people before World War II, the company has a current payroll of some 1,700, and an annual turnover exceeding £3 million. About one-third of its output is for export, and a vigorous drive for the European market was started by the company four years ago. In this connection, the chairman travels completely round Europe at least twice a year, visiting the 14 countries in which sales agencies have been established, in addition to frequent visits to major towns on the Continent, the Middle East, and farther afield for routine business.

There are also 27 selling centres for Woods' industrial (and domestic Xpelair) fans throughout the main cities of the U.K., with a sales staff of about 150 and, at the moment, a less urgent demand for executive aircraft liaison. Another large sales field, however, for the company, with a pressing communications problem, is Central Africa, where there is an increasing demand for the crop-drying blower and heat exchanger equipment developed by Woods of Colchester. New techniques developed for the forced drying of such crops as coffee, rice, cocoa, tea, wheat, etc., have opened fresh markets in territories with particularly difficult communications problems.

It was in Central Africa that the practical advantages of light aircraft for executive travel were really brought home to Mr. Woods, during a World tour in 1958. He had arranged with the Woods' agent in Nairobi for a 10-day tour of Rhodesia, Tanganyika, the Congo and adjacent areas, without specifying the precise means of travel. Anticipating an exhausting round of trips by train, car and airline, he was surprised to be confronted with a chartered Cessna 180 at Wilson Field, Nairobi, and amazed to find his tour completed in about half the specified time with the minimum of effort.

Although Mr. Woods had learnt to fly at Broxbourne in 1930, and had obtained his licence on Moths, his further contact with aviation was limited to being an extremely experienced but frequently disgruntled airline passenger. Among the many shortcomings which he quotes for commercial services in Europe are the lack of a seat booking facility, resulting in an unseemly rush to board the aircraft, and the occasional unexpected suspension of flights, as was the case on New Year's Day between Paris and London by B.E.A. and Air France because of the Continental holiday.

Having decided to look into the possibilities of obtaining an executive aeroplane, following his Central African trip, Mr. Woods set about getting all the available brochures on American types, while continuing his World tour, and

First of its kind to be registered in this country, Woods' Aero Commander is one of the new 500B series, with "slim-line" nacelles and is specially fitted with an extra door in the port cabin wall to facilitate cargo handling. It also has full lightweight de-icing equipment.

Below, Mr. Peter Wellby, executive pilot of Woods of Colchester, Ltd., took delivery of the Commander 500B in the United States from Aero Commander Inc. sales manager and record-breaking pilot Miss Jerrie Lee Cobb.

REPRESENTATIVE OPERATING COSTS, AERO COMMANDER 500B

ANNUAL UTILIZATION	500 hr.	600 hr.	750 hr.	900 hr.	1,000 hr.
FIXED ANNUAL COSTS	Cost in pounds per flying hour				
Depreciation: Aircraft together with radio package for all weather flying depreciated over 8 years down to a residual value of 20%	8.60	7.17	5.73	4.77	4.30
Insurance: Annual premium 4% of aircraft first cost	3.44	2.87	2.30	1.91	1.72
Hangarage: Based on a rental of £10 per week	1.04	0.83	0.69	0.56	0.52
Crew: Assuming salary to be £2,500 per annum	5.00	4.17	3.33	2.78	2.50
HOURLY COSTS					
Maintenance and Overhaul: Airframe—Estimated	1.90	1.90	1.90	1.90	1.90
Engines—based on 900 hour life overhaul cost of £750 (10% added for intervening maintenance.)	1.83	1.83	1.83	1.83	1.83
Propellers—based on 1,000 hour life overhaul cost of £150 (10% added for intervening maintenance.)	0.33	0.33	0.33	0.33	0.33
Fuel and Oil: Fuel consumption of 24 gallons per hour and average fuel price of 3s. 9d. per gallon. 4% added for oil	4.68	4.68	4.68	4.68	4.68
Landing Charges: Based on Ministry of Aviation charge of £2 2s. per landing	2.40	2.40	2.40	2.40	2.40
Total operating cost per flying hour	29.22	26.18	23.19	21.16	20.18
Cost per aircraft mile—shillings	3.3	2.9	2.7	2.47	2.38
Cost per passenger seat mile—pence	6.66	5.83	5.33	5.00	4.66

methodically listed comparative data and performance on each, within the light-twin class. He finally selected the Beech Travel Air, with two 180 b.h.p. Lycoming 0-360 engines, as appearing the most suitable for his requirements, telephoned the Beech company at Wichita from Los Angeles, and then flew down for a demonstration from New York. He bought the Travel Air on the spot and it was subsequently ferried across the Atlantic to be based at Colchester.

One of the first snags to be encountered was the fact that like so many towns in Britain, Colchester has no airport, although it is surrounded by disused airfields. On one of these, Boxted, permission was obtained to keep the Beech, but no hangarage or indeed accommodation of any kind is available, and the runways are breaking up through inattention and wear and tear from heavy farm vehicles. Hangars are available at the adjacent airfield of Wormingford, from which permission to operate has so far been unobtainable from Air Ministry, although the M.o.A. have been very helpful.

Used primarily by the chairman, the Beech soon proved its value as a time-saver. The best possible train connections between Colchester and Birmingham result in a 5-hr. journey, whereas the Beech did it in about an hour. Glasgow is 11 hr. by train, compared with 2 hr. by aircraft, plus 25-30 min. to get to the city centre. Flown by the company pilot, the Travel Air also took the chairman on the long haul down to Nairobi, and its utilization was such that before its C. of A. was due, it ran out of hours for engine overhaul.

The Lycoming overhaul life in the U.S. had been extended from 750 to 1,150 hr., but the only concession obtainable from A.R.B. was a provisional increase from 750 to 950 hr.—on *one* of the Travel Air's two engines. This, Mr. Woods felt, was not a great deal of use, and resulted in the Beech being *hors de combat* for some time. While confirming the value of executive aircraft, the Travel Air had also proved slightly too small for the company operations, which often included air freighting. A successor was therefore sought which would cope with the average passenger load factor of three persons, and at the same time be quickly adaptable for a useful load of freight.

Mr. Woods wanted a small aircraft with a lively performance and a good capacity, including up to seven seats. For simple freight loading and general accessibility, a high-wing layout was considered essential, which substantially narrowed the light-twin field. For the minimum operating costs, the Aero Commander 500B, with two 290 b.h.p. Lycoming IO-540 engines, was finally selected for final approval by Mr. Peter Wellby, who had joined Woods of Colchester as company pilot in July, 1960.

With an initial basic price of £34,200, including 17½% duty, the Commander 500B has the same payload as several larger light twins, and with the normal internal fuel of 130 Imp. gal., a maximum range of about 1,250 miles. When required, the rear seats in the cabin can be rapidly removed, and up to 1,500 lb. of light freight carried in their place. For full all-weather utilization, the Commander was specified with Goodrich lightweight de-icing boots on the leading-edges of the wings and tail assembly, together with rubber shoes on the three-bladed airscrews.

Radio selection was correspondingly comprehensive, with Collins 360-channel VHF, incorporating VOR, plus marker receiver and ILS; Sunair 22 HF, and ARC-21A radio compass. No autopilot was specified, despite single crew operation, and stability of the Commander is such that the need for a pilot aid is only occasionally apparent during IFR conditions in particularly busy airways.

Peter Wellby took delivery of the Woods' Commander, aptly registered G-ARGW, from the factory at Bethany, Okla., at the end of November, 1960, and ferried it uneventfully across the Atlantic soon afterwards. Its first trip was on Dec. 15, when it cleared Customs at Southend (10 minutes' flying time from Boxted, and in Woods' experience one of the most efficient airports in Europe, only Zürich being comparable) and flew a load of freight—fans, spares, machine parts—to Düsseldorf. Woods' European sales manager was picked up from Düsseldorf and flown to Paris; Peter Wellby was back in Colchester for tea.

Since then, G-ARGW has been to most of the big cities in Europe, including Oslo, Zürich, Brussels, Amsterdam, Paris and Malaga, and only two of its trips have been within the U.K., to Manchester and Birmingham. The flight to Manchester, carrying executives to a conference, took one hour by air, compared with at least six by train. In its initial operations, the Commander has proved to have a fuel consumption of 22 Imp. gal./hr., for a normal cruise speed of 165 knots at 7-11,000 ft. (65% power), giving a ground speed in the region of 195 m.p.h.

Its safe cruising endurance of about 5½ hr. enables it to fly non-stop from Southend to Malaga in favourable conditions, although a refuelling halt is sometimes necessary. Auxiliary tanks are to be available for the Commander, and the 60 U.S. gal. kit installation will probably be incorporated. The radio installation selected has proved very satisfactory, the HF set proving particularly useful in the mountainous areas of Spain, where much longer operating ranges are available—up to 1,500 miles—than with VHF.

Maintenance of this busy aeroplane has been in the hands of Field Aircraft Services, which means that hitherto, G-ARGW has been one of the very few executive aircraft permitted to fly into London Airport. Happily, these sacred precincts are to be made more widely available, but the Commander has had a good serviceability record, with only a booster pump failure, a mag. short and heavy tyre wear from the rough runway surface at Boxted on the snag sheet.

Use of the Commander is planned on a long-term basis, with the overall programme subject to amendment as required by short-term commitments. As a company aeroplane, the Commander is operated through the factory transport section, and so far as Mr. Woods is concerned, it is just another vehicle, although with an unusual earning potential. Mr. Woods is determined to enlarge his executive aviation unit, and is thinking of the possibility of air-freighting his entire output to Europe.

To succeed in the export drive, it is essential, in his opinion, to give better service in delivery than local producers. He has produced some figures showing the actual times achieved, on an average, for goods to be freighted by normal surface means between Colchester and various capitals of Europe. These include Vienna, 21 days; Brussels, 15 days; Copenhagen, 10 days; Paris, 16 days; Holland, three days (by Harwich night service); Milan, 17 days; Oslo, eight days; Lisbon, 28 days; Zürich, 16 days.

These figures speak for themselves in supporting Mr. Woods' contention that the Customs organizations are still geared to the horse and buggy days, since it is in their hands that the goods spend much of their travel time. In his opinion, airport administration is still years behind the aircraft themselves, so that commercial air-freighting is too slow, apart from being ridiculously expensive. Transport costs by air can easily amount to more than the cost of the product.

For these reasons, he foresees a growth in his company's own air-freighting effort, and is watching with interest the development of such types as the Short Skyvan. One or two of these small freighters could fulfil his European airlift requirements, and also be available as a 10-seat "conference collector." Alternatively, something like a DC-3 might be an invaluable addition to his executive fleet, but whatever the technical choice, the stakes involved in expansion within the European market are high enough to make the wider use of aircraft virtually essential.

For the markets farther afield, it is not possible to reduce executive travel times below those of the commercial jet services, but there is a possibility that a Woods' aeroplane may be based, for example, in Salisbury, Rhodesia, for business flights around the local sales area. Despite his enthusiasm for executive and business flying, Geoffrey Woods is far from being an aviation enthusiast. Aeroplanes as such do not interest him; like all our more imaginative industrialists, he sees them realistically as expensive and specialized tools which have unique capabilities in expanding sales. Stripped of superfluous glamour, this is the rôle of the aeroplane in industry—JOHN FRICKER.

Personal Flying

McAlpine Aviation have assembled a Piper Comanche for its Certificate of Validation on behalf of Mr. Colin Chapman, designer of the world-renowned Lotus sports and racing cars. Mr. Chapman bought the aircraft—a red and ivory four-seater—in the United States. It was dismantled and shipped to the Luton Airport headquarters of McAlpine Aviation, the business flying division of Sir Robert McAlpine and Sons, Ltd.

The Comanche will be used by Mr. Chapman both for business—flying to motor racing meetings in Britain and on the Continent—and for pleasure. The Lotus companies already have one other aircraft which they use, a four-seater Miles Messenger. The Comanche will be kept at Panshanger, near Hertford, but maintenance will be in the hands of McAlpine Aviation at Luton.

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A successful "take-over bid" has been made by Oxford Aviation, Ltd., for Coventry's flying club. The Oxford company, which operates its own flying club at Kidlington, Oxford, intends operating two Piper trainers from Baginton Airport for flying instruction, and Piper Apaches for executive flying.

The Coventry Aeroplane Club will retain its name and premises at Baginton, but will be only a social club. The two organizations at Coventry will be entirely separate, with their own premises and staff. This is expected to be the first of a number of moves by Oxford Aviation to operate from various airports and airfields in Great Britain, using Piper aircraft for which it holds a dealership. Oxford Aviation also operates an executive service from Birmingham.

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The Dowty Group has entered an agreement with the McCauley Industrial Corporation, a subsidiary of Cessna Aircraft, for the sales and servicing of light aircraft propellers in Europe and the Commonwealth. An option for a period of two years has also been taken by Dowty for the manufacture of McCauley airscrews under licence for supply to the same territories.

McCauley propellers are to be fitted to the Beagle light aircraft, which are also to have Continental engines manufactured by Rolls-Royce under licence. The operating company in the Dowty group will be Dowty-Rotol, Ltd., producers of airscrew equipment for more than 20 years. The company's extensive background in this field will be at the disposal of light aircraft manufacturers in the designated territories.

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Grantair, Ltd., of Grantchester, Cambridge, has established a maintenance base with 12,000 sq. ft. of hangar area, at Sywell, Northampton. This is responsible, under chief engineer G. R. "Bob" Hampshire, for maintaining various private and commercial aircraft ranging from Austers and Tri-Pacers to a DC-3.

An aircraft road transporter is available; and as the engineers themselves are mobile, in certain circumstances they are prepared to undertake maintenance of aircraft on site. Aircraft are also available from Sywell for sale or hire.

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● The Lancashire Aero Club reports that its January flying total was not only the highest for the same month over the past four years, but also highest for the past three months. Following the guarantee of 180 hr. flying by 15 members, a Tri-Pacer is being obtained, and will be operated at £7 an hour, or 3½d. per seat/mile.

● January was also a good month for the Surrey and Kent Flying Club, which is pondering the problems of re-equipment at the moment. First solos have been flown by Mr. V. A. Roberts, Mr. R. E. S. Roberts and Mr. J. B. Garrod.

● Two members, Alan Johnson and Antonio Podolski, of the Norfolk and Norwich Aero Club have recently qualified for their P.P.L.s at Swanton Morley. First solos were achieved by John Wilkins and Trevor Taberham.

● With less than 100 hr. recorded during January, the Tiger Club took a rather poor view of the weather, which resulted in Redhill becoming partially submerged. Club members have now been graded for proficiency in type qualification, glider-towing, parachute-dropping, etc., with cards endorsed for "general flying" (excluding aerobatics), "general flying and aerobatics over 2,000 ft." and the eventual aim of "all types of flying performed by the Tiger Club."

Gliding Notes

by Dr. A. E. Slater

MORE high climbs have been done in the R.A.F. Wave Project since a British two-seater altitude record of 20,100 ft. was put up on Feb. 14 by Flt. Lt. G. McA. Bacon and M/E A. Eldridge. On Feb. 23, in a S.E. wind to leeward of the northern end of the Pennines, Corp. Tech. C. Philip Jeffery reached 20,000 ft. from a 3,000-ft. launch in a Skylark 3, earning a Diamond for altitude; M/E Eldridge climbed to 16,000 ft. from 3,200 ft. in an Olympia; and Sqn. Ldr. J. Lindsay Bayley 14,100 ft. from 2,200 ft., flying an Eagle solo.

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ANNUAL trophies were presented at three gliding clubs in the last week-end of February. An Imperial College member won the Brunt Trophy for the first time; it is given annually for the highest climb by an undergraduate member of a University gliding club, and hitherto it has always gone to Cambridge. The winner is David Ashford, with a climb of 13,900 ft.

There appears to be no other specifically University gliding club in the country.

The London Club's annual dinner was held at a hotel in Dunstable for a change. The Dent Cup was awarded for a 300-km. triangle by Philip Jeffery, whose performance at Carlisle the day before is reported above. As a result of this effort he now has the Gold "C" with two Diamonds.

Colin Richardson, now in Pakistan, had the Foster Trophy for 162 miles from Dunstable to Cranwell and back; Cedric Vernon the Derry Trophy for technical work for the club; and Les Collins the Desoutter Cup for building a superb trailer.

Guest of honour was the only founder-member "still active"; to justify this description he flew solo again the previous Sunday after a two-seater check.

[Dr. Slater is too modest to mention his own name.—Ed.]

At the Cambridge Club Siegfrid Neumann came easily top of the President's Ladder with 1,675 points (reckoned by complicated mathematics) and shared with John Brenner the Pot Pewter Pringle; P. W. James won the Pons Pot with a flight to Benson, and Tony Best the Measure Massive Menkevich for a Silver "C" goal flight to Horsham St. Faith, Norwich.

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LECTURES on soaring, for those who have only recently learned to soar, are being given weekly at the Kronfeld Club (74 basement, Eccleston Square, near Victoria Station) on Thursday evenings at 20.00 hr., from now until Apr. 13, omitting Mar. 30. Lectures still to come are on navigation (Mar. 9), field landings, meteorology, instruments, and competition flying. Non-members may attend, and the cost is 3s. 6d. per lecture or 15s. for the course.

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WINTER thermals appeared at the Cambridge University Gliding Club on Jan. 15, and Peter Jones, who kept the Skylark 2 up for 33 minutes, found several centres of lift under a narrow cloud street. The weather chart shows an anticyclone whose centre had moved to the North Sea after being over England the day before, so the previous history of the air cannot easily be traced. Upper air figures show an inversion of 1° C. between 4,000 and 4,500 ft., with an isothermal layer in the next 1,000 ft. above.

In addition to six courses for elementary pupils during the Long Vacation, the Cambridge Club intends to hold three "advanced soaring courses" at times to be announced later. While advanced soaring is now taught by many instructors as part of club routine, I do not remember any club holding a special course for advanced soaring since that of the Yorkshire Club in July, 1938. At that one I learned to climb in thermals, but was completely self-taught.

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TALKING of his South African trip at the Kronfeld Club, Denis Burns mentioned an extraordinary evening thermal, if that was the right term, coming up from Kimberley airfield and its surroundings when he got back from his World out-and-return record; it lifted him at 1 to 2 m./sec. to 18,000 ft., and, by the time he landed, the stars were coming out.

Storks in those parts, he said, only flap up to 50 ft. before starting to soar in a thermal. They will not soar, however, in company with a sailplane pilot as many other birds do.

However, I remember a pilot in Germany once claiming to have shared a thermal with storks and outclimbed them, which suggests that a tropical thermal could lift a sailplane at only 50 ft. But it would not be wide enough to circle in, though a thermal "street," perhaps over a runway, might be soarable at 50 ft. by flying in a straight line.

Industry Record

Link-up in Canada

A jointly owned subsidiary, DCF Systems, Ltd., has been formed by three major companies in Canada. These are Canadian Aviation Electronics, Ltd., Ferranti-Packard Electric, Ltd., and de Havilland Aircraft of Canada, Ltd. Purpose of the new company is to undertake management design, development and manufacture relating to commercial and military equipment programmes in those fields where the companies' capabilities and facilities are complementary.

As its first project, DCF Systems, Ltd., is working with Boeing to provide management assistance and technical support at the R.C.A.F. Bomarc base at North Bay.

Directors of the new company are Mr. J. F. Tooley, Mr. J. Fogarty, Mr. D. B. Annan, Mr. L. D. Clarke and Mr. W. H. Jackson, who is also appointed general manager. Its head office is at Downsview, Ontario.

Intercoms for the Army

Ultra Electronics, Ltd., is to supply its UA60 intercom equipment for use in the Westland Scout helicopters at present on order for the Army Air Corps. Approximate value of the contract, which calls for the supply of 40 sets, is £21,000. Delivery of the equipment will begin in the summer.

Electronics Agent

Aero Electronics, Ltd., of Gatwick Airport, has been appointed exclusive U.K. distributors for Edo (Canada), Ltd., the Canadian licensees of Burnell and Co., Inc., California. The complete range of Burnell electronic components can now be obtained from the company. Catalogues are available for interested manufacturers.

A Redux Process Press

At the Hatfield factory of the de Havilland Aircraft Co., Ltd., a heavy press capable of exerting a thrust of 3,000 tons has recently been installed. This has been supplied by Head Wrightson Teesdale, Ltd., and is designed for the Redux process of metal-to-metal bonding by adhesion under temperature and pressure control. It has a clear table access of 36 ft. x 9 ft. and is of welded construction, each platen comprising four fabricated H-sections tied together at the ends by heavy cross beams.

The four main rams are each of 750 tons capacity, single acting, and are arranged within the corner posts. They are flange-mounted to the top platen with pivot reactions between the rams and thrust plates. Upward travel is through four secondary rams each of 100 tons capacity and mounted in line with the main rams. Automatic levelling of the press is achieved by differential control between main and secondary cylinders.

Process controls for Reduxing operation together with necessary press controls are housed in a combined cubicle suitably positioned to give a clear view of the press. The pumps and valve assemblies are arranged below floor level adjacent to the press. The two prefill tanks are positioned above the cylinders between the corner posts, one at each side. Guards are arranged at all access points. Safety keys are provided to ensure that all guards are proved down before operation of the press can begin.

The Head Wrightson Redux process press being erected at the Hatfield factory of the de Havilland Aircraft Co., Ltd.

The Latest on Lox

One company that is anticipating the large-scale adoption of liquid oxygen (or Lox) breathing systems in aircraft is British Oxygen Aviation Services, Ltd. Since 1957 liquid oxygen systems have gradually been reintroduced into service aircraft (it was abandoned in 1930 after 12 years of development by the R.A.F.), and on Jan. 1 this year M.o.A. regulations made necessary the provision of an emergency oxygen breathing system in civil turbine-powered transports.

To begin with, a Lox system has considerable advantages over its gaseous counterpart—it is lighter, safer and smaller. The 25-litre system developed by British Oxygen for the Argosy C.1 and Comet 4C for Transport Command weighs only 102 lb. High-pressure oxygen cylinders to supply the same amount of gas are estimated to weigh 401 lb.

Much of the credit in the reintroduction of Lox to R.A.F. and Royal Navy aircraft must go to British Oxygen. Apart from the 25-litre system already mentioned a 3½-litre system was evolved for use in smaller types and is now used in the Buccaneer, Gannet AEW.3, Gnat Trainer, Lightning and Sea Vixen.

In developing Lox systems for transport aircraft British Oxygen has worked closely with the Walter Kidde Co., Ltd., who are responsible for the actual emergency mask storage systems. The masks are hidden in individual compartments for each row of seats and are ejected when a pressurization failure occurs. Oxygen is blown out until the aircraft descends below 15,000 ft. Then pressure is reduced by half and the oxygen must be sucked from the mask.

A British Oxygen development designed for the smaller executive and private owner range of aircraft is the Harlow Mk. 2 portable set. The complete system, weighing only 25 lb., is carried in a lightweight case and will provide sufficient oxygen for four persons cruising at 15,000 ft. for 2½ hr.

Equipment designed after research work by British Oxygen's Morden and Harlow laboratories has done much to solve the problem of wastage by evaporation when liquid oxygen is being stored. New super-insulants have made it possible for a 60-ton Lox storage tank with a loss of only 5% a year to be built. On the military side mobile producing plants are required and such a range has been produced for airfield and aircraft carrier use.

Other equipment produced by B.O.A.S. includes 75- and 185-litre dispensers and storage tanks to hold 500 gal. or more. A mobile liquid oxygen producing plant has been designed for use at remote stations where the more normal means of liquid oxygen supplies are not readily available. The newer of the Navy's carriers also have their own producing plant.

So that the aircraft industry, airline companies and the Services may keep abreast of developments in Lox, British Oxygen runs a training school at its Harlow factory. Courses are in such demand now that places have been filled well into 1962.

In collaboration with the M.o.A. the company has evolved a method of suppressing explosions in pressurized aircraft fuel tanks by using liquid nitrogen.

A British Oxygen 50-gal. vacuum-insulated dispenser replenishes the Lox system of a Gnat Trainer.

Correspondence

Same School—Same House

WHAT Wren did not point out in "Air Cdre. E. M. Donaldson Retires" (Feb. 24, p. 201) is that all four Donaldsons were at the same school—Christ's Hospital (same house what's more). Other R.A.F. notabilities from the same stable—R. G. Seymour, L. F. Sinclair, H. A. Constantine.

London, W.1. "OLD BLUE."

Tons, Long or Short?

BE a bit silly wouldn't it if they gave the weight of ships in pounds instead of tons? Even trawlers, let alone the "Queen Mary"! So let's have the weight of airliners like the 707, Comet, VC10 and the like in tons not pounds as that would be easier to visualize. Even Lightnings, Hunters and little things like that are better in tons. We've passed the Gladiator, Grebe and Spitfire days long ago and aircraft are getting quite heavy.

London, W.14. GEOFFREY DORMAN.

Away with Windows!

I AM convinced that the high-flying air transports of the future will be without cabin windows. Instead, the passengers will have a view of the proceedings (when suitable) on a wide-angle television screen recording from a scanning camera in the nose of the aircraft.

At the moment passengers can only see the frightening murk or the blinding glare and often run out of runway long before the pilot does.

As an air traveller with many thousands of miles in my log I am sure that there are plenty to agree with me.

London, S.W.16. CHARLES SIMS.

Collectors' Pieces

I HAVE been trying for a long time to obtain photostat copies or, if possible, originals of the descriptions of the Fokker Dr. I, D.VII and D.VIII which no doubt must have appeared in THE AEROPLANE around 1918. This is for my private collection, not for trade or any other journalistic purpose. I work as a service engineer for Canadair, Ltd., at Montreal and this interest in aviation history is just a hobby now in its 36th year.

Can any reader help me?

14834 Elmwood Avenue, H. VOLKER.
Pierrefonds, P.Q., Canada.

Accident Reports

YOUR "Review of Accidents in 1960" (Jan. 13, pp. 34/35) is extremely well done: I sincerely hope it will, henceforth, become a regular annual feature in your journal.

However, in the interests of truth and complete accuracy, I must take to task your writer's own comments which I quote, ". . . The fact that *more passengers* [my italics] were not killed in these incidents is a tribute to sound structural design, good airmanship—and good fortune." Your writer is referring to "landing incidents" relating to Boeing 707s and he takes care to point out "six of the nine" such incidents relate to these aircraft! In fact, *no passengers were killed* in any of the six 707 "landing incidents" which are faithfully recorded in your tabulation!

Furthermore, to put your author's comments into proper perspective I would like to point out that (up to the end of 1960) the reputation of the Boeing 707s is certainly no worse than that of the de Havilland Comet 4s. In fact, if one takes the number of 707s in service during the period under review, compared with Comets, the Boeing's "landing incidents" record is superior to that of the Comet's!

According to *Lloyd's List*, in a nine-month period from June, 1959, to March, 1960, a total of four Comets (all operated by B.O.A.C.) were involved in similar "landing and approach incidents" to those of 707s. I will not further enlarge on other serious Comet "incidents" except to remark that the total certainly does not stop at the modest figure of four only! The fatal accidents (to date) of 707 training flights must not be confused with scheduled and/or charter passenger-carrying flights by these aircraft: "emotional issues" are bad enough in too many fatal airline accidents. For this reason (and many other sound ones I could also quote) the 707's safety record, from October, 1958, to December, 1960, is something that's astonished its most harsh critics.

In conclusion I must again take you to task on a particular comment you've made in your Editorial. In the recovery of aircraft wreckage from the bottom of the sea you are incorrect when you state "in no other instance has an effort of such magnitude been made to recover aircraft wreckage . . ." (referring to both the H.P. Victor 2 and the Comet 1 off Elba). May I remind you that you yourselves referred in some detail to a very similar salvage operation in the Gulf of Mexico which went on for many months in 1953. The aeroplane was

Wroundabout

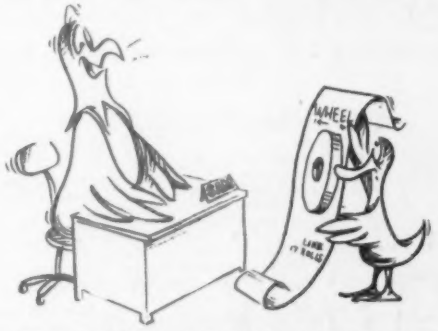
United We Fly. Picture if you can United Air Lines executives in profound conference—"Must have something *new* . . . what *can't* a passenger do? . . . Well, men can't smoke pipes or cigars . . . Why not? . . . Women! . . . O.K., let's have a no-women service . . . a for-men-only flight—smoke what they like, take off their coats, loosen their ties, dig into a man-size steak! Put it on the N.Y.-Chicago evening run . . . use our old DC-6's . . . We could call it . . . er, how about Chicago Executive? Sure, let's go . . ." And they did and it is and you can, if you're a man. Another thoughtful touch would be an all-male cabin staff so that comment may be unconfined when a diversion or delay is announced.

*

Thank you. Greetings to the war-time Australian friend who recently addressed a letter to "My old cobber Chris Flamin' Wren, may he never spin in, the old b———" and then marked it "Personal."

*

"Strictly Birdmanship" is the title of another pungent booklet by Bernard Benson and Jack Roberts, whose "Engineersmanship" earned Wroundabout's accolade when it was published some



"Tremendous idea—come back when the Russians have done it and we'll be able to get it sponsored with no trouble at all."

two years ago. The new volume comments, in the cynical fashion you see here, on government-sponsored research and development and is obtainable from the Benson-Lehner Corpn., Santa Monica, Calif., U.S.A. Benson, who does the writing, was a former R.A.F. and R.A.E. pilot; Roberts, the illustrator, was a U.S.A.A.F. pilot.

*

Tempus Fugit. "Avro News" tells of a pilot who dreamt that he was flying a Shackleton on a long reconnaissance flight and woke up to find that he was.

*

Fire Fix. Sgt. "Flash" Penfold, who lives some distance from his Norfolk airfield, was motoring to work one morning when he was stopped by an agitated lady who told him her house was on fire and implored him to stop at the first telephone he came to and call the Fire Brigade. Shortly after, "Flash" was trying to describe to them the location of the house. Finally he said "Look, you can't miss it—it's the only house on fire."

by Wren

a National Airlines DC-6 (N90893) which disappeared on Feb. 14 of that year while flying between Miami and Tampa.

I'll say no more except to refer you to your issue of Feb. 4, 1955, pp. 149/150, report "The Way Accidents Happen"!

Nairobi, Kenya. DENNIS M. POWELL.

[Our comment about landing accidents, in the "Review of Accidents in 1960" was made quite clearly with reference to *all* such incidents, and not simply those to Boeing 707s as Mr. Powell seeks to imply in his second paragraph. The Boeing 707 has completed 500,000 hours of airline operation and carried about 12½ million passengers so far—a record probably unequalled by any other single type of aircraft, and one which speaks for itself without the need of apologists.—ED.]

Private Pilots and Communications

COULD you explain to me the meaning of the last sentence of your "leader" headed "Tightening the Control" (Feb. 17, 1961)? For those who cannot remember it, here it is again:—

> "The problem then, is to make the private pilots better disposed and this can be done by simplifying the communications channels."

For a moment I thought we had a Ministry Publications author trying to break into the more popular Press. In short, it might pass in an Information Circular but it will not do for THE AEROPLANE AND ASTRONAUTICS.

Moving on to p.162 under "Matters of Moment" I see that I can use L.A.P. (Restrictions Slashed!) if I could only get through the Zone to get at it. In this pantomime season I do not think it out of place to draw a parallel here with Prince Charming hacking away at the dense undergrowth in order to reach his Sleeping Beauty. However, his job would seem to be something of a "doddle" and his two-edged sword would appear to have changed hands somewhere along the way, so let's forget it.

To summarize, one is tempted to stop flying and take up something less vicious (e.g., writing letters to periodicals, snake breeding, etc.). But that we must never do—we must keep flying despite all restrictions. In fact here we come to the point of this letter. I am sure all flying men will be pleased to hear that, subject to a guaranteed membership of 2,000, I intend to form a company to be known as "The Dogger Bank Aero Club, Ltd." (followers of the Saro Princess please note we intend to have at least one in our fleet).

The success of this venture depends of course on the receipt of a written dispensation from the Minister of Agriculture and Fisheries and a series of Summit Talks with British and Icelandic trawlermen. Then, of course, we might get in the way of a few submarines or *vice versa* and it may be necessary to set up Seaways, or nautical corridors 10 nautical miles in width, ranging in vertical extent between Mean Low Water Springs to Mean High Water Springs—but if we can only get the First Sea Lord as chairman, etc., etc., etc., blah, blah.

Rawdon, Leeds J. STUART HOARE.

[We stand rebuked and properly. Perhaps on reflection Mr. Hoare will concede that he has laid it on rather thick. Our error, surely, arose from compression rather than any form of double-speak. We are convinced that all aircraft, other than those flying for fun around airfields, should be able to receive information from, and transmit information to, Air Traffic Control. But, equally, we hold the view that the authorities for their part must see that extremely simple radio equipment can be used for the job. Such radio communication to work on the smallest number of channels must be available; we understand that experts are satisfied that five would be adequate; we do not presume to know. As we said, what is needed is to simplify the means of communication between aircraft and controller.—ED.]

Getting to the Airport

THE system used in Paris (see "The New Orly," p. 228, and Editorial, p. 219, in last week's issue), whereby the passenger makes his own way to the airport, is already applicable to Gatwick, which has properly planned connecting transport arrangements. But it cannot, surely, be applied conveniently to Heathrow unless and until there are major improvements in the overall communication pattern.

So far as Heathrow is concerned the passenger who prefers to by-pass the town terminal is already finding that:—

(1) Large items of luggage cannot be taken on tubes and buses.

(2) Taxi drivers will not often agree to take them to any point as far away as Heathrow, and then only at inflated fares.

(3) The occasional traffic jams in the airport tunnel and beyond can cause serious delays to private cars and taxis.

(4) Parking space for private cars is not always immediately available in the central area.

A town departure/arrival terminal with frequent, regular coach (or other) services to the airport will probably always be necessary, whether or not the passenger is "processed" there.

London, S.W.3. A. H. HENDERSON.

Aviation Calendar

Mar. 10

Farnborough.—GAPAN lecture, "The SC.1," by T. W. Brooke-Smith, at The Empire Test Pilots' School, at 19.30 hrs.

Feltham.—R.Ae.S. L.A.P. Branch Third. Sir Richard Fairey Memorial lecture, "Sailing," by Uffa Fox, at the Feltham Hotel, at 18.30 hrs., followed by the branch dinner, at 20.00 hrs.

London.—British Gliding Association Annual Ball, at Londonderry House, 19 Park Lane, W.1, at 20.30 hrs.

Mar. 11

Birmingham.—B.I.S., Midland Branch lecture, "The Origin of Life," by O. E. Lowenstein, in the Birmingham and Midland Institute Cinema, Paradise Street, at 18.30 hrs.

Mar. 13

Amesbury.—R.Ae.S. Boscombe Down Branch lecture, "Airships," by the Rt. Hon. Lord Ventry, in the Lecture Hall, A. and A.E.E., at 17.30 hrs.

London.—R.Ae.S. Historical Group lecture, "The Evolution of Transport Aircraft," by P. W. Brooks, in the Lecture Theatre, 4 Hamilton Place, W.1, at 19.00 hrs.

Mar. 14

Kingston-upon-Hull.—Hull University Air Squadron Annual Dinner, at the Guildhall, at 19.35 hrs.

Luton Airport.—R.Ae.S. Luton Branch lecture, "Hovercraft," in the Napier Senior Staff Canteen, at 18.00 hrs.

Mar. 15

Bristol.—British Institution of Radio Engineers, South Western Section lecture, "Airborne Servo System for Throttle Control," by D. W. Thomasson, at the School of Management Studies, at 19.00 hrs.

Hatfield.—R.Ae.S. Branch lecture, "The Strength of England," by Dr. Barnes N. Wallis, in the de Havilland Restaurant, at 18.15 hrs.

London.—Kronfeld Club lecture, "Collision Experiments with Wire Barrage Weapons," by Gp. Capt. Kent, in the Basement, 74 Eccleston Square, S.W.1.

Mar. 16

Liverpool.—The British Institution of Radio Engineers, Merseyside Section lecture, "Flight Simulators," by D. J. Mauchel and R. Marvyn, at The Adelphi Hotel, at 19.00 hrs.

London.—R.Ae.S. Astronautics and Guided Flight Section, All Day Symposium on "The Training of Guided Missile Engineers," in the Lecture Theatre, 4 Hamilton Place, W.1, at 10.30 hrs.

Mar. 17

London.—R.Ae.S. Man Powered Aircraft Group lecture, "Power Transmission Systems," by S. S. Wilson, in the Lecture Theatre, 4 Hamilton Place, W.1, at 19.00 hrs.

London.—Institute of Navigation lecture, "Long-term Plan for Air Traffic Control," by Capt. V. A. M. Hunt, at the Royal Geographical Society, 1 Kensington Gore, S.W.7, at 17.15 hrs.

Company Notices

NEW COMPANIES

BRITISH SPACE DEVELOPMENT CO., LTD. (683,158).—Private co. Reg. Feb. 10. Cap. £1,000 in £1 shs. To carry out any activities in the fields of natural or applied science, particularly scientific research (inter alia) in the fields of aviation, aeronautics, aerodynamics; the exploration of outer space; the propulsion and direction of vehicles, missiles and artificial satellites. Sols.: Linklaters and Paines, 59-67 Gresham Street, E.C.2.

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HUNTING SURVEYS (SPAIN), LTD. (683,793).—Private co. Reg. Feb. 17. Cap. £100 in £1 shs. To carry on the business of prospectors and exploiters of hydro-carbons; geophysicists, geologists, surveyors, photographers and photogrammetrists. Directors: Trenham D. Weatherhead, 35 Ossulton Way, N.2. George M. Adams, Palmers Lodge, Allum Lane, Elstree, Herts. George S. Highcock, 13 Glenmere Avenue, N.W.7. Sec.: G. S. Highcock. Reg. off.: 4 Albemarle Street, W.1.

LIONE (MERTON), LTD. (683,589).—Private co. Reg. Feb. 16. Cap. £1,000 in £1 shs. To carry on the business of buyers, sellers, manufacturers, repairers, importers and exporters of all kinds of component parts for aircraft, engines, automobiles or precision engineering tools and equipment. Directors: Donald E. Lione, 54 Hill Road, Mitcham, Surrey. Ivor Troostwyk, 81 Cricklade Avenue, S.W.2. Sec.: Ivor Troostwyk. Reg. off.: 124 Merton High Street, S.W.19.

CHANGES OF NAME

British Eagle International Airways, Ltd. (561,051), 12 Low Pavement, Nottingham.—Name changed to Cunard Eagle Airways (Holdings), Ltd., on Jly. 28, 1960.

Eagle Airways, Ltd. (521,316), 32-50 Edgware Road, W.2.—Name changed to Cunard Eagle Airways, Ltd., on Jly. 28, 1960.

New Patents

APPLICATIONS ACCEPTED

865,514.—**H. D. Fowler.**—"Convertible aircraft." Jne. 26, 1959.

865,523.—**Link Aviation, Inc.**—"Navigation training apparatus."—Jne. 11, 1957. (Jne. 11, 1956.)

865,524.—**Soc. Nationale d'Etude et de Construction de Moteurs d'Aviation.**—"Annular-wing aircraft."—Jne. 21, 1957. (Jly 2, 1956.)

865,568.—**N. Smith.**—"Vertical take-off aircraft." Jne. 3, 1959. (Mar. 4, 1958.)

Printed specifications of the above will be available on Apr. 19, 1961, and the opposition period will expire on Jly. 19, 1961.

Personal Notices

BIRTHS

Carter.—On Feb. 16, at R.A.F. Hospital, Ely, to Joan, wife of Flt. Lt. N. Carter—a daughter.

Colbeck.—On Feb. 22, at R.A.F. Hospital, Cosford, to Eileen (*née* Mohan), wife of John Colbeck—a daughter.

Jakeway.—On Feb. 23, at R.A.F. Hospital, Wegberg, to Frances (*née* Pettitt), wife of Flg. Off. D. Jakeway—a son.

Richardson.—On Feb. 22, at R.A.F. Hospital, St. Athan, to Marianne, wife of Flt. Lt. F. W. Richardson—a daughter.

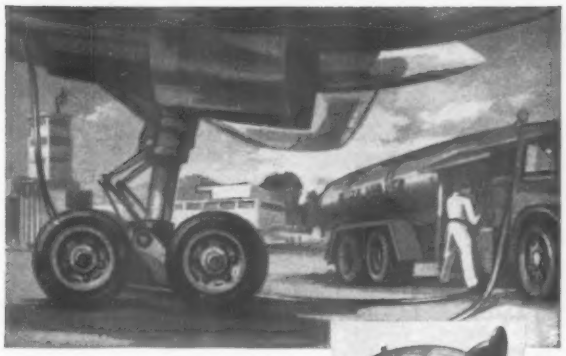
Wilson.—On Feb. 20, at R.A.F. Hospital, Halton, to Deborah, wife of Flt. Lt. D. W. Wilson—a daughter.

DEATHS

Aron.—On Feb. 20, Wg. Cdr. John Leonard Aron, M.B.E., at Jurby, Isle of Man.

Bigsworth.—On Feb. 24, Air Cdre. Arthur Wellesley Bigsworth, C.M.G., D.S.O., A.F.C., R.A.F. (retd.), at Plowlands, Little Easton, Dunmow.

Maxwell.—On Feb. 21, Gp. Capt. C. H. H. Maxwell, R.A.F. (retd.).



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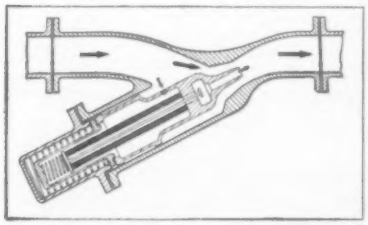

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AUSTER Autocar. 4-seater tourer, constructed 1953, only 920 t.s.h., 426 engine hours, s.m.o.h., Fairey Reed metal prop., dual, battery, generator, starter, silencer, new C. of A., £1,535.
CESSNA 170B. Superlative 4-seater tourer, 330 engine hours, s.m.o.h., Lear V.H.F., Omniscope V.O.R.; cross-wind landing gear, new C. of A., £3,250.
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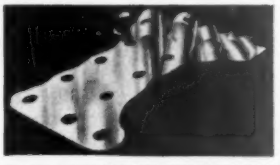

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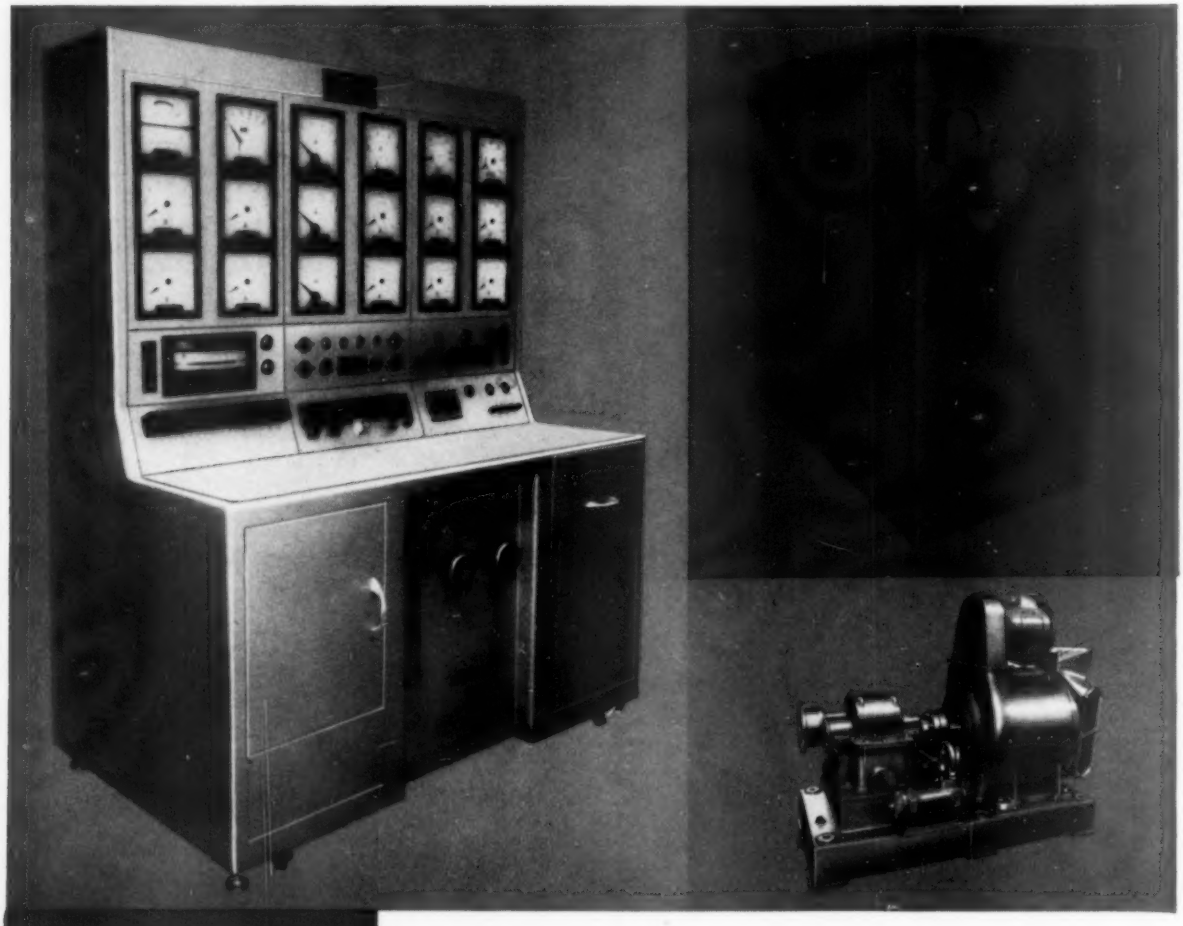

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